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CHILD DEVELOPMENT

This number reports studies of infant responses, of articulatory defects and verbalization in memory, of emotional instability and friendships, and of a child's use of criticism.

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CHILD DEVELOPMENT

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The Effect of Group Training Upon the Correction of Articulatory Defects in Preschool Children

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SPEECH development in young children has received much attention from investigators of child behavior since the beginning of the century. In recent years the biographical records of vocabulary growth have been supplemented by systematically controlled studies of vocabulary, sentence length, and parts of speech, on large groups of children. Among these the works of Bateman (1), Smith (21), and McCarthy (14), have added much to our knowledge of language acquisition.

The articulation phase of speech, however, has been neglected in the preschool years. Surveys on large numbers of school children at various ages from kindergarten to college, conducted by Wallin (29), Root (19), Blanton (5), Conradi (10), and Stinchfield (25), indicate that a considerable percentage of the school population possess speech defects. The estimates range from 2.46 per cent (Conradi) to 19 per cent (Stinchfield); but in general the authors agree that the percentage of defects decreases from kindergarten on. These investigators and others interested in corrective speech education agree that training in articulation should begin in the primary or early elementary grades. Wile (32), Brigance (8), Martin (5), and Case (9), all state that corrective training should be instituted in the plastic years of early childhood, and place the emphasis on the early school grades as the most practicable time and place for speech instruction. The statements of Gesell (12), Stinchfield (22), and the Blantons (4), however, indicate that these authors consider the preschool years as the most fruitful training period. Logical and reasonable as these opinions are, they as yet lack the support of experimental studies.

In a study of 172 pairs of lispers in grades 1 to 12, Berry and Stoddard (3), found improvement in 98.3 per cent of the experimental group and in only 45.3 per cent of the controls after training. Improvement was apparently little related to intelligence, age, home language, and sex. The correlation between extent of defect and amount of improvement was positive. A recent study of speech sounds of children from two to six done at Iowa (31) revealed that at three

[1] From the Institute of Child Welfare, the University of Minnesota. Condensed for periodical publication by Mary Shirley.

years each consonant blend was given correctly by at least 20 per cent of the children, each consonant element by 30 per cent, each vowel by 60 per cent, and each diphthong by 70 per cent. By five years the percentages had increased respectively to 40, 40, 70, and 80. A high correlation was obtained between age and correctly given speech sounds; the relationship remained high when mental age was held constant.

From this brief review of the literature it is evident that more experimental work on articulatory defects should be done at all ages, and particularly on the preschool child.

PURPOSE

The purpose of this study is to determine to what extent preschool children with articulatory defects who are given group corrective speech training improve as compared to similar preschool children who are given no training. A secondary purpose is to learn how such improvement may be related to factors other than training, such as chronological age, I.Q., sex, school attendance, paternal occupation, and education of the parents.

SUBJECTS

A total of 34 nursery-school children, ranging in age from 26 months to 59 months, and 27 kindergarten children, ranging in age from 57 months to 67 months, were tested for articulatory speech defects, and from these two groups, the subjects used in the experimental group for this study, together with their paired controls, were drawn. The children were enrolled in the nursery-school and kindergarten of the Institute of Child Welfare, University of Minnesota.

TEST USED

The Blanton-Stinchfield Speech Measurements (6), Articulation Test (A-No. 1) Part II was adapted for use. In some instances, it was too difficult for the younger nursery-school children, but with slight modification, was made applicable. The test consists of charts, about 9 x 11 inches, on each of which are 9 pictures of familiar physical objects and animals. The child is asked the question written under each picture, the answer to which contains the sound being tested for, in its desired position, initial, medial, or final, and in strong form. The 21 consonants, 3 nasals, and 1 glottal aspirate defined by the International Phonetic Association, together with 10 blends, or double consonants were tested for in this study. Including the 3 positions (initial, medial, and final) in which most of the sounds were tested, the test altogether consisted of 75 different sound items. No vowels were tested for.

Because many of the pictures were beyond the level of the children, especially the younger nursery children, other stimuli were substituted if the child did not respond to the question in regard to the picture being shown. For example, a zebra is shown to elicit the initial sound "z." Since very few children recognized the animal, it became necessary to get the sound either by imitation (a method resorted to as infrequently as possible, and when used, care was

taken that the mouth of the speaker was not visible to the child) or, by talking about overshoes, and finally, after endless questioning, getting the response, "zipper."

TESTING PROCEDURE

The children were tested individually in a quiet room free from distracting stimuli. An assistant[2] trained in speech work elicited the sounds from the child; and the sounds were recorded independently by the author and J. Roderic Springob, who also used the material collected in his research work. The sounds were recorded on a blank containing the conventional phonetic symbols for all the sounds in their three positions. The symbols decided upon by the International Phonetic Association were used; for purposes of publication they have been converted into their English letter equivalents. Notation was made in three terms, sounds correctly given, sounds omitted, and other sounds substituted for the correct sounds. Doubtful cases were tried a second time with another stimulus word if necessary. For example, a picture of a tree was given to elicit the initial "t." A few subjects who were unable to make the "t" because of the "tr" combination did make "t" in "toe" or "tie." With the younger children the testing procedure was sometimes shortened by checking sounds other than those being tested for at the moment. For example, in testing "h" in hat, the final "t" might also be checked; in cases of doubt it was rechecked by the regular stimulus word.

All the children were tested originally in December 1929 and January 1930 and were retested in April and May of that year. The mean time required for testing both nursery school and kindergarten groups was 25 minutes; and for retesting, 20 minutes with the younger, and 18 with the older group.

The reliability of the simultaneous record taking of Sommer and Springob was extremely high. Correlation coefficients for the age group from 26–46 months were .98 $\pm$.003 for test and .99 $\pm$.004 for retest; and for the 47 to 59 months group were .99 $\pm$.003 for both test and retest, there being 17 cases in each age group. While these coefficients are extremely high, it must be pointed out that they represent only the agreement between the two raters in respect to the total number of defects and do not take into consideration which sounds were substituted for or omitted.[3]

PAIRING

The experimental (or training) groups and the control groups were drawn from all the cases who had been judged by the writer to have three defects or more. Three defects were arbitrarily decided upon as the dividing line, because they gave us enough subjects for the experiment, while a higher number of defects would not.

[2] The writer wishes to thank the assistants, Margaret Blanford and Helen Thorvilson.

[3] These coefficients in no sense represent the reliability of the test; and the consistency of the raters might better have been determined by computing the percentage on sounds recorded identically by the two raters. M.S.

However, one kindergarten child who had only two defects was included in the control group in order to be paired with one in the experimental with three defects because she paired best on all the factors upon which the pairing was based.

There were three groups of pairs made:

(1) 11 Experimental nursery children with 11 paired Controls.

(2) 3 Experimental kindergarten children with 3 paired Controls.

(3) 3 Experimental kindergarten children who entered school late, were younger and had only one-half the corrective work which was given to Experimental groups (1) and (2), and their paired Controls. This is called the six-weeks group.

Pairing was done on the basis of (1) speech defects, taking into consideration the omissions and substitutions; (2) C.A. at the first test; (3) I.Q. on Minnesota test; (4) days of school attendance prior to the test; (5) education of the parents; and (6) paternal occupation according to the classifications based on the Barr scale of occupational intelligence and the Taussig industrial classification, which have been revised for the Minnesota population (13).

Table 1 shows the closeness of the experimental and control groups in the various factors on which they were paired. Although the pairing was not perfect in every detail, yet the two groups were as nearly equal as the small number of cases permitted. In all cases speech defects were considered the most important item in the pairing.

THE CORRECTIVE PROGRAM

The corrective work, with the exception of the 3 younger experimental kindergarten cases who entered late and were given just one half the work of the nursery and older kindergarten, was begun in January and continued for 12 weeks. For convenience the nursery group was divided into two, an older and a younger which were given 15 minutes each day. Both kindergarten experimental groups were also given 15 minutes a day, 5 days a week.

On account of absences and holidays the children who were trained for 12 weeks did not receive 60 days of work; nor did the 6 weeks children have 30 training lessons. The mean number of training periods for the nursery school groups was 38.7, for the older kindergarten 47.0, and for the younger kindergarten (6-weeks group) 22.0.

The training was given by the writer who had been trained in speech correction but who had never before taught a class of preschool children. In the two nursery school groups there was always a practise teacher assisting. The corrective period was called "games" by the nursery school and kindergarten teachers who coöperated most helpfully in trying to build up in the children pleasant associations with the experimenter and with the speech period. The class usually started with a relaxation exercise, the children's favorite being, *The Land of Noddy-Pod.* The following verse was repeated softly and slowly by the

teacher while the children performed the actions.

Softly we will rest,
In our little nest,
Put away our feet (cross feet)
Tuck around the sheet (arms folded)

After the relaxation the remainder of the period was spent in games, dramatizing nursery rhymes, and doing simple action, voice and tongue exercises. The source of many of these was Barrows and Case (2).

TABLE 1

Closeness of experimental and control groups after pairing

PAIRING FACTORS	NURSERY SCHOOL GROUP		KINDERGARTEN GROUPS*			
			(Older)		(Younger)	
	Experimental	Control	Experimental	Control	Experimental	Control
Speech defects:						
M.	16.46	15.36	14.67	12.33	14.33	13.67
S.D.	13.31	9.10				
C.A. at date of 1st test:						
M.	43.00	42.73	64.00	62.33	60.00	58.67
S.D.	5.98	7.70				
I.Q. (Minnesota):						
M.	120.54	115.73	101.67	110.00	109.00	108.00
S.D.	14.69	7.22				
School attendance prior to the test (days):						
M.	140.00	143.82	66.33	212.67	39.00	44.33
S.D.	96.84	85.58				
Education of the parents (years of father plus years of mother):						
M.	25.64	26.00	18.50	20.42	31.00	26.33
S.D.	4.92	7.84				
Paternal occupation:†						
M.	2.46	3.00	3.33	2.67	2.33	2.67
S.D.	.99	1.35				
Number of cases	11	11	3	3	3	3

* Standard deviations are omitted on the kindergarten groups because of the small number of cases.

† Average parental occupation was computed by assigning an arbitrary weight of 1 to occupational class I; 2 to occupational class II, and so on.

Snug as a pea in a pod
With a yawn and a gap (children yawn)
And a dreamy little nap (close eyes)
We will go, we will go
(repeat very softly)
To the Landy-oddy-oddy,
Of the Noddy-oddy-oddy,
To the Landy-andy-andy-andy
Of Noddy Pod.

Some of the exercises were the windmill game wherein the children made the "th" as in *this*, accompanied by waving of arms like windmills; animal sounds such as s-s-s-s-s (goose), z-z-z (bee) and engine and machinery sounds such as tch-tch; and the old-

time favorite "Here we go round the Mulberry bush." The remainder of the training consisted of word drills. In all the games the experimenter enunciated very clearly and exaggerated slightly her lip, tongue, and jaw movements. Occasionally a direct reference was made to the defective sound of an individual child, but the usual procedure was group practice on all sounds made incorrectly by children in the group.

From the second week of therapy on, small hand mirrors were used for 5 minutes at a time, one or two days a week. Apparently they helped some in the kindergarten group, but they were not so satisfactory as a large mirror in which both children and teacher can look at once. The small mirrors encourage "fooling" and make it difficult for the child to shift attention from the teacher's mouth to his own.

The first improvement noted was in a boy, who on the fifth day learned to say the initial "th" sound as in *thumb*. He was very proud of his accomplishment and for at least two weeks, whenever another child was being corrected, he would say, "I can say "thumb" can't I, Mrs. Sommer?" The "v" sound was corrected early in many children. A Valentine was promised to everyone on Valentine's Day who could say "Valentine," which may partly explain their early correction of this sound. However, another reason seems to be that it is a sound, the making of which is easily explained: "Let's bite our lower lip, children." This is also true of both "th" sounds; "Let's put our tongue between our teeth." All the children were very proud of their corrections accomplished and tried to out-shout each other as to what they could say *now*.

Sitting-down exercises and games were alternated with standing-up and running games to provide frequent change, stimulation, and to keep up interest. This was especially true in the nursery groups in which there were difficult children whose occasional unwillingness to come with the group and whose unwillingness to coöperate in the group were a constant source of difficulty to the assisting teacher and the writer. However, that their behavior was similar outside the speech class was a fact which prevented the writer from feeling too much discouragement. In spite of the behavior difficulties, one of these children improved 82 per cent.

It might be interesting to state here that of the half of the experimental group (12 weeks) who improved most, all but one (the one just referred to who improved 82 per cent) were considered by the writer to be the most coöperative and interested of all the children.

ANALYSIS OF RESULTS

Inasmuch as the means of Springob's and Sommer's test judgments are the figures used in this study as the measure of the child's defects on the first test and on the retest, it might be well to justify such treatment at this time on the basis of an analysis of the independent judgments of the two testers. Such justification is necessary, at least for the use of the mean measure on the second test, because any prejudice of the writer on this

test in favor of the experimental group and to the disadvantage of the control group, would invalidate the use of the other direction on the retest; although at the retest he had forgotten most of the children who had

TABLE 2

Comparison of the test results of Sommer and Springob

	SOMMER DATA				SPRINGOB DATA			
	Defects		Improvement on defects	Per cent improvement	Defects		Improvement on defects	Per cent improvement
	Test I	Test II			Test I	Test II		
Experimental group (17 cases)								
Mean	15.76	6.53	9.24	58.58	14.29	6.47	7.82	54.73
S.D. dis	13.69	8.97	6.41	22.59	11.30	9.04	5.34	26.56
Average of Sommer-Springob:								
M	15.03	6.50	8.53	56.75				
S.D	12.46	8.99		21.41				
Control group (17 cases)								
Mean	14.53	10.76	3.76	25.92	13.88	9.82	4.06	29.24
S.D. dis	9.00	6.92	4.60	25.76	8.45	6.31	4.84	27.10
Average of Sommer-Springob:								
M	14.21	10.29	3.91	27.54				
S.D	8.61	6.59		24.34				

Probability of true differences existing

DIFFERENCES BETWEEN:	D/σ_D	CHANCES IN 100
Sommer Test I and Springob Test I:		
Experimental group	1.99	98
Control group	.96	83
Sommer Test II and Springob Test II:		
Experimental group	.11	54
Control group	2.61	99
Test I and Test II, experimental group:		
Sommer	5.88	100
Springob	5.92	100
Test I and Test II, control group:		
Sommer	3.40	100
Springob	3.90	100
Average improvement of experimentals and controls	2.77	99.7
Per cent of improvement of experimentals and controls	3.44	100.0

her test results. It is also possible that Springob, who assisted in the pairing might have been prejudiced in

been placed in the training group, he did remember a few cases.

Table 2 makes a comparison be-

tween the test results of the two raters. In the original test Sommer found slightly more defects than Springob for both experimental and control groups, but the critical ratios between differences and standard deviations of the differences do not quite meet the usual criterion of significance (3.0). On the retest the two raters disagree even less on the experimental group, but on the control group the likelihood of Sommer's finding more defects than Springob rather closely approaches the significant ratio (2.61).

Both raters find, however, a significant decrease in defects for the experimental group after training; and they also find an almost equally significant decrease in defects for the control group, although the critical ratios are not quite so high for the control group as for the experimental. The agreement between the two raters in all the tests, with the possible exception of retests on controls, is quite high, a fact that lends credence to the results and that in a measure justifies the average of the two raters' judgments in further statistical treatment. From these averages it appears that the experimental group has a percentage of improvement about twice as great as that of the controls (56 per cent and 27 per cent, respectively). In actual elimination of defects the experimental is twice as efficient as the control, (8.5 and 3.9).

Individual records show somewhat more strikingly the effects of training. Three children in the control group failed to improve at all, whereas none in the experimental group failed to improve. No child in the control group equalled the median of the experimental in per cent of improvement, while all 17 of the experimentals exceeded the median per cent of improvement of the untrained. In the untrained group only 3 children eliminated more defects than the median of the experimental, whereas 16 of the experimentals eliminated more defects than the median of the control.

Correlations were computed to show relationship between first and second tests. These correlations, done by the Pearsonian formula, when corrected for regression were:

	EXPERIMENTAL (17 CASES)	CONTROL (17 CASES)
Fewness of errors on Test I with per cent of Improvement...	+.67±.09	−.04±.16
Fewness of errors on Test I with Improvement in Defects.....	−.07±.16	−.84±.11
Fewness of errors on Test I with fewness of errors in Test II.....	+.90±.03	+.86±.04
Fewness of errors on Test I with C.A....	+.04±.17	+.06±.17

The correlation between fewness of errors on Test I and fewness of errors on Test II is quite high for both experimental and control groups. These coefficients are virtually measures of the reliability of the test, and they indicate that neither training nor lack of it substantially altered the relative positions of the children in the group with respect to speech defects. The correlation between initial errors and per cent of improvement suggests that in the trained group those with fewer defects improve most, whereas

in the untrained group no relation exists between original status and per cent of improvement. In actual number of defects, however, the untrained groups shows a high negative correlation between initial status and improvement; this means that children with more defects eliminate more than those with few, probably simply because they have more to get rid of. Chronological age showed practically no correlation with initial errors.

Correlations were also worked out between per cent of improvement and the factors of C.A., M.A., I.Q., parents' education, days of school attendance, and days of training. All were low and had high probable errors, so that no significant relationships were established.

Age and sex differences

The fourteen children who had 12 weeks of training and their paired controls were divided into two age groups, from 30 to 46 months and from 47 to 65 months. This division failed to show any significant differences between older and younger groups in per cent of improvement. The efficacy of training was revealed for both age groups, however, in that both younger and older experimentals had a significantly higher per cent of improvement than the younger and older controls respectively.

Sex differences were very slight but rather consistently favored the girls. Both experimental and control girls were somewhat better than boys on the original test, and both groups of girls likewise had a higher per cent of improvement than the boys. For the experimental group the sex differences had a critical ratio of 2.0, thus bringing the ratio close to the margin of significance; in the control group the girls were not quite so superior to boys on the original test and their improvement was greater than the boys by only a little better than chance (critical ratio .79). For both boys and girls the experimental group improved more than the control.

Analysis of improvement by sounds

On the basis of the Sommer records the improvement in sounds for each of the three positions was analyzed for both experimental and control groups. The results for the 14 children who had 12 weeks of training and their controls are shown in table 3. For each type of error, substitutions and omissions, and in each position, initial, medial and final, the experimental group had a greater per cent of improvement. In total substitutions, the experimental group had a per cent of gain twice that of the controls. On the surface the difference between experimentals and controls in per cent improvement in omissions looks even more significant, but it really is less significant because the number of omissions in all cases were few and were confined to a few children rather than distributed among all in the group. With regard to the positions it appears that defects in the initial and medial positions improve about half as much without training as they do with training over a 4½ months period. Errors in the final position are harder to eliminate without training, it would seem, since the control group eliminated 0 per cent of their

TABLE 3

Differences between 12 weeks' experimental and control groups in substitutions and omissions in initial, medial and final positions

GROUP	INITIAL				MEDIAL				FINAL				TOTAL			
	1st	2nd	Gain	Per cent	1st	2nd	Gain	Per cent	1st	2nd	Gain	Per cent	1st	2nd	Gain	Per cent
Substitutions																
Experimental	75	29	46	61	41	24	17	41	62	32	30	48	178	85	93	52
Control	94	59	35	37	43	29	14	33	57	55	2	4	194	143	51	26
Omissions																
Experimental	10	1	9	90	19	1	18	95	18	3	15	03	47	5	42	89
Control	1	1	0	00	8	5	3	38	3	5	−2	−67	12	11	1	8
Substitutions and omissions																
Experimental	85	80	55	65	60	25	35	58	80	35	45	56	225	90	135	60
Control	95	60	35	37	51	34	17	33	60	60	0	00	206	154	52	25

TABLE 4

Differences in improvement of single sound defects, classified phonetically, between the experimental and control 12 weeks' groups

CLASSIFICATION	EXPERIMENTAL (12 WEEKS)			CONTROL (12 WEEKS)		
	1st test	Gain	Per cent gain	1st test	Gain	Per cent gain
Acoustic:						
Atonic	55	40	72.73	64	34	53.12
Tonic	119	72	60.50	92	21	22.83
Anatomic:						
Bi-labial	7	5	71.43	5	1	20.00
Labio-dental	18	17	94.44	6	−1	−16.67
Lingua-dental (pre-dental)	38	30	78.95	55	33	60.00
Lingua-rugal (alvelar)	84	43	51.19	83	21	25.30
Lingua-palatal	5	5	100.00	3	0	00.00
Lingua-velar	22	14	63.64	4	1	25.00
Physiologic:						
Glottal	0	−2	−200.00	0	0	
Plosive	41	26	63.42	24	12	50.00
Fricative	129	84	65.12	132	43	32.58
Nasal	4	2	50.00	0	0	

final errors whereas the experimentals eliminated 56 per cent.

Consonant classification

Using the Borden and Busse three-fold classification of consonants, with slight modifications, the improvement in the two groups was again analyzed. These results are given in table 4.

The most outstanding differences between the experimental and control groups according to the classification just referred to are in: tonic or voiced consonant sounds in which the im-

provement of the former is 60.50 per cent and the latter 23.83 per cent; in lingua-rugal or alvelar consonant sounds in which the experimental with 84 defects on the first test improves 51.19 per cent, while the controls, with 83 on the first test improve only 25.30 per cent or about one-half as much; and in fricative consonant sounds in which the improvement of the experimental group with 129 errors in this category is 65.12 per cent or twice that of the controls who improve 32.58 per cent on 132 original defects. In addition to these three classifications, the experimental improvement in per cent is about 20 per cent more than the control in the atonic sounds and about 19 per cent more in the lingua-dental sounds. These are the only other categories besides those discussed above which have enough original defects in both the experimental and control groups so that a comparison between them is not unreasonable or unwarranted. We are probably justified in saying that corrective work, as compared to no corrective work, with preschool children seems more effective in tonic than in atonic consonant sounds, in lingua-rugal consonants than in the other anatomic classifications, and in fricative than in plosive sounds.

Blends

Table 5 shows some decided differences between the experimental and control groups in their correcting of blends. The blends included in the Blanton-Stinchfield Speech Measurements Test (6) are kl, fr, nk as in bank, pl, fl, gl, tr, br, gr, and lz. While the two groups are practically equal on the Test I with 51 blends defective in the experimentals and 50 in the controls; the former gain 23 or 45 per cent after 12 weeks of training, while the latter not only do not improve but instead add 3 more defects to their original 50, during the period between the two tests.

TABLE 5

The effect of 12 weeks training in the correction of defective blends

GROUP	N	1ST TEST	GAIN	PER CENT GAIN
Experimental.....	14	51	23	45
Control.....	14	50	−3	−06

Omissions

The omissions of five children, three of them experimentals and two controls, who omitted 5 or more sounds on the original test were analyzed to see how they were corrected. Only 11 of the original 96 omissions remained on the second test; 49 had been corrected entirely, but 36,— more than a third, —had merely been changed to a substitution. The child having the most changes from omissions to substitutions was one of the youngest of the group. Her case raised a question in the author's mind as to whether the change from omissions to substitutions might not be a definite step in the development of articulation in young children, a possibility that is suggestive for further study on children between the ages of two and three.

Hardest and easiest sounds

According to Test I, the easiest sounds (those wrongly given 5 times or less) for both experimental and control groups were m, b, h, p, w, t, d, n, ng, and f. The hardest, those given wrongly 15 times or more, were v, th,

(both voiced and voiceless) z, sh, zh, tch (as in watch), j (as in jig), l, and r. These lists of hardest and easiest sounds agree well with those recorded by other observers. The sound most easily corrected by the trained group was v; that easiest for the controls was sh. Both groups improved greatly on both the sounds th and j, but experimentals improved somewhat more than controls on zh, r, and y (as in yellow). Experimentals showed no improvement on pl, b, and regression on h and t; controls showed none on y, tr, fr, and wh, while they regressed on v, s, z, l, t, g, gl, br, and lz. Many of these sounds are on the list of easy ones, a fact which suggests that the easiest sounds to make by the majority may not be the easiest to correct by the minority.

CONCLUSIONS

1. Consistency of the two raters on the speech tests, as measured by correlations between number of errors, was high, +.98. Consistency of the children's scores after a 4½ month interval was also high, +.90 for experimentals and .86 for controls.

2. After a twelve weeks' interval preschool children showed improvement in articulation regardless of whether they have been trained systematically during the interval.

3. Improvement in the trained group was 57 per cent, about twice that of the untrained group, 28 per cent, when gain was measured in percentage.

4. The experimentals exceeded the controls in number of defects eliminated by a difference that was 2.7 times its standard error; and in per cent of gain they excelled to the extent indicated by a difference of 3.4 times its standard error.

5. Improvement was approximately the same for younger and older age groups both of experimentals and controls.

6. Sex differences were slight but apparently favored the girls.

7. Improvement was noted for sounds in all three positions, but those in the final position seemed hardest to eliminate without training.

8. There was a suggestion that original omissions, especially in the younger children, changed to substitutions on the retest.

9. Classification by sounds showed a few differences between experimentals and controls that are interesting from the phonetic standpoint.

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The Latent Time of the Body Startle in Infants*

Orvis C. Irwin

THE data reported in this article are incidental to an investigation of auditory intensity thresholds of eyelid responses, and of the body startle in newborn infants.

The pattern of the *Schreckreaktion* or body startle has been described by Peiper who stated that the whole body jerked together, both arms extended and then returned in a clasp to the trunk, the elbows being flexed. The fingers were first extended, then clinched. The movements of the legs were similar but weaker.

This reaction was first studied by Moro (2) who later used it for diagnostic purposes (3). Watson (7, 8) has interpreted it as the basis of fear in children. Peiper (4) measured the latent time of the body startle in one infant between the second and fourth months and found it to be .25 second, the mean deviation being .067 second. In this study the latent time of 163 body startles in 12 infants varying in age from fifteen hours to fifty-three days has been measured. Six infants were males and six were females. The number of trials from infant to infant was not kept constant.

* From Iowa Child Welfare Research Station, State University of Iowa, Iowa City, Iowa.

The infant was placed on a two-dimensional stabilimeter within a Pratt experimental cabinet (1). The tone was furnished by a loud speaker placed four inches from the crown of the infant's head. The stimulus was a loud tone of 581 cycles with a duration of .07 second. Its intensity was not measured but was sufficient to cause a startle in adults who were not expecting to hear it. The loud speaker was hooked into the output circuit of a three-stage audio-oscillator. An eccentric on the shaft of a synchronous motor which drove a polygraph controlled both the output of the oscillator to the loud speaker and a pen which recorded the stimulus on the moving tape of the polygraphs. The body jerk of the infant was translated by the stabilimeter to the writing pens of the polygraph, the resulting movement being traced on the moving polygraph tape. The movement of this tape was practically constant, the error being less than one-third of 1 per cent. The distance from the stimulus record on the polygraph tape to the inflection point of the response curve gave a measure of the body startle.

Table 1 presents 163 latent times of the body startle in 12 infants. The

mean latent time is .18 second. These values vary from .07 second to .35 second. The probable error of the distribution is .03 second and the probable error of the mean is .003 second.

(Valentine, 6.) It differs, of course, from simple reactions in that it is an involuntary response. The value with our infants is somewhat less than that of Peiper's (4, 5) who reported it to be

TABLE 1

Latent times of the body startle in twelve infants

INFANT	SEX	LATENT TIME (SECONDS)							
1	F.	.349	.156	.180	.261	.144	.144	.240	.156
2	M.	.145	.145	.163					
3	M.	.181	.200	.072	.160	.270	.180		
4	F.	.163	.181	.200	.145	.145	.163	.163	.145
		.200	.236	.145	.127	.145	.163	.145	.163
		.163	.145	.145	.163	.218	.145	.200	.145
		.145	.163	.309	.163	.163	.127	.127	
5	M.	.145							
6	F.	.290	.163	.181	.163	.189	.181	.127	.145
		.181	.109	.145	.145	.145	.290	.163	.181
		.181	.145	.236	.145	.163	.163	.163	.181
		.181	.145	.236	.145	.254	.145	.145	.272
		.145	.145	.290	.345	.127	.127	.254	.163
		.127	.200	.290	.181	.200	.200	.145	.290
		.254	.218	.163	.218	.145	.145	.127	.145
		.127	.181	.200	.266	.127	.127	.145	.163
		.163	.200						
7	M.	.204	.145	.168	.192	.156	.192	.253	.277
		.265							
8	F.	.180	.156	.168	.144	.204	.156	.168	.144
		.132	.156						
9	M.	.218	.127	.163	.145	.145	.236	.218	.254
		.218	.236	.163					
10	M.	.163	.145						
11	F.	.145	.127	.145	.109				
12	F.	.290	.145	.218	.127	.181	.218	.127	
		.109	.254						

Mean	.18
Probable error of distribution	.03
Probable error of mean	.003

The latent time of the body startle thus approximates the values for simple auditory reaction time in adults. Values have been reported ranging from .149 to .204 second. .25 second on one infant. One of our infants (Infant 12) is comparable in age with the infant whose latent period was measured by Peiper. The value for this infant is .19 second.

The following tabulation shows the mean latent times for each of the 12 infants:

INFANT	SEX	BODY STARTLES	LATENT TIME
1	F.	8	.20
2	M.	3	.15
3	M.	6	.18
4	F.	31	.17
5	M.	1	.15
6	F.	66	.18
7	M.	9	.21
8	F.	10	.16
9	M.	14	.19
10	M.	2	.15
11	F.	4	.13
12	F.	9	.19
Total.....		163	

These mean values vary from .13 second to .21 second.

The mean latent times of the body startle by days is given below:

DAYS AFTER BIRTH	INFANTS	TRIALS	MEAN LATENT TIME
1	4	15	.18
2	2	9	.18
3	2	17	.19
4	2	34	.17
5	3	21	.17
6	2	27	.20
7	1	11	.20
10	1	2	.15
11	2	5	.14
14	1	9	.16
18	1	3	.18
53	1	9	.19

The data is more adequate for the first seven days than it is for later days. However, it will be seen that the variations are slight except on the eleventh day due probably to poor sampling on that day.

The following tabulation shows that the mean latent time for six male infants is .19 second and for six females .18 second:

	MALES	FEMALES
Trials.....	35	128
Mean latent time.....	.186	.177
Probable error of distribution.....	.03	.05
Probable error of mean....	.004	.004

There is no significant difference between these values so that it may be concluded that there is no sex difference in the latent time of the body startle in infants.

An interesting observation in this study of newborn infants is that crying never accompanied these body startles to loud tones. On the other hand, eyelid responses were observed to occur even when no other overt response was observable, the lids closing upon stimulation if they were open, or tightening if closed.

The following conclusions may be drawn from these data:

1. The infants responded to loud tones either by a body startle or eyelid responses.

2. The eyelid response (closing or tightening) was observed to occur even when the body startle was not elicited by the loud tone.

3. The mean latent period of 163 body startles following a tone of 581 d.v. with a duration of .07 second made by twelve infants from fifteen hours to fifty-three days old is .18 second; the standard deviation is .03 second.

4. The shortest latent period was .07 second.

5. The latent time of the 163 body

startles (involuntary response) is comparable to that of simple auditory reaction time in adults.

6. There was little change in the mean latent time from day to day.

7. There was no significant difference in the mean latent time of six boys and six girls.

8. Crying never accompanied these body startles.

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Verbalization as a Factor in Learning*

MARJORIE K. PYLES

IN THE present study the problem was to determine the influence of verbal symbols in the development of form discrimination. The method used was to compare children's learning scores on three series of problems of the multiple choice type. In series A and in series B the stimulus objects consisted of five green papier-mâche moulds of the same height (2 inches) and of approximately the same size. They differed, however, in external contour, being modelled in a variety of "nonsense" 3-dimensional forms. Series C consisted of five familiar animals (a cat, dog, rabbit, bear, and monkey). These were 3 inches in height, and were made of celluloid; as the celluloid proved to be too light to withstand daily handling, a filling of plaster of paris was poured into the interior of each object, in order to give weight and stability. In all three series, a cup-like opening was left at the bottom of each object, permitting a small toy to be hidden inside. These toys, serving as reward objects when a correct selection was made, consisted of 25 toy animals, ½ of an inch in height.

The subjects for the experiment were 80 nursery school, kindergarten and first grade children from the University of California Institute of Child Welfare, the Berkeley Day Nursery, and the University Elementary School. Since in this experiment it was necessary to compare learning scores for three different series of test material, it was deemed advisable to rotate the tests in comparable groups of subjects, in order to control practice factors. With six possible orders of testing (A B C, A C B, B A C, B C A, C A B, C B A) six equivalent groups were necessary; these were obtained by a process of matching, taking into consideration C A., M A., school and sex.

The instructions for series A were: "One of these shapes has a toy under it; see if you can find which shape has a toy." The child's first efforts are of course purely trial and error; after a successful choice, he was asked where he had found the toy. When he indicated the "correct" object under which the toy had been located, the experimenter would say, "Yes, that one had it." This procedure, calling the child's attention to the correct object, was for each series employed on the first three trials, and at every third trial thereafter. The purpose of this was to maintain an interest in "getting it right the first time," and

[1] This problem was suggested by Professor E. Harold Jones and the experiment was carried out under his direction. Thanks are also due to Dr. Virgil Dickson for assistance in procuring data in the Berkeley Public Schools.

to counteract any tendency to fall back on random choices. After the first trial, a screen was erected in front of the child, and the five objects were quickly rearranged, a new toy being concealed under the same stimulus object as in the previous trial. The problem was considered solved when the child's first choice was correct in four successive trials. If a solution was not reached in 25 trials, the experiment for that day was discontinued. At the next sitting, the series was reduced to four objects, the previous "correct" object being omitted; if necessary, 25 trials were again given, and at the following sitting, the series was reduce to three, and then to two objects. The number of stimulus objects in the set-up was decreased in this manner because it was believed that the frequency of complete failures, at the lower age levels, would be reduced by this procedure, while with the older children adequate differentiation would still be maintained. As far as possible, tests on the same series were made two days apart. Two weeks after the completion of a given series (with a maximum of 100 trials on four different days) the child would be started on a second series, according to the sequence (ABC, or CBA, etc.) prescribed for his particular group.

In Series B the same procedure was followed, except that the child was encouraged to verbalize his successful performances, through the use of a name for the "correct" object. After the child found the toy on his first trial, the experimenter asked where he had found it, and then said "The name of that shape is Mobie." "Can you say that?" "All these things have different names. I'll tell you their names." The names given the five shapes were Mobie, Kolo, Tito, Gamie, and Bokie. The "correct" names were rotated, and the actual objects employed in Series A and B were also rotated, so that the average difference between these two series would be wholly one of procedure. Care was taken to insure that the actual amount of time spent on the named series (due to the naming process) was not greater than that spent in pointing out the objects in the unnamed series. In Series C (familiar animals) the children usually named the animals spontaneously; if they did not do so, the name was supplied by the experimenter in the first trials.

A record was kept of the objects picked up on each trial, the verbal responses and remarks made by the child, and his attitude toward the task.

RESULTS

The relative difficulty of the animal, named and unnamed series is indicated by the comparison of the learning scores shown in table 1. The scores compared are those obtained by the children on the learning problem they were given first. The mean and median number of trials required for the solution of the three problems are given, and the percentage completely failing each problem. It is of interest to note that practically all the children solved the animal problem in less than twenty-five trials (i.e., with five stimulus objects in a set-up) whereas 42 per cent solved the named and only 4 per cent the un-

named series within this number of trials.

The solution of the problem in each of the three series is dependent on the child's realizing that the toy is always under the same object, and his being able to recognize the "correct" object as such from among the others. After a child has solved one of the problems, he knows on the two succeeding series that the toy is always to be found under some one object. It is therefore to be expected that the scores obtained on the series given first to a group would be higher than the scores of the same series when given second or third, to equivalent groups. Comparisons, therefore, should be made with reference to order of practice, or with reference to composite data in which all orders are averaged.

Table 1 suggests that a marked difference exists in the difficulty of the three series; the difference between the named and the unnamed series is interpreted by the writer as due to the factor of verbalization. The difference between the named series and the animal series may also be due in part to this factor, since the animals bear names which are already familiar, while the names of the nonsense objects are learned during the experiment, and are applied with relatively less readiness and certainty.

It remains only to be demonstrated that the differences are not a function of ability differences in the groups, nor of extraneous factors in the procedure. This is shown by tables 2 and 3, which give the same order of differences as table 1. The averaged

TABLE 1

Comparisons of scores on the series presented first

GROUPS	SERIES PRESENTED FIRST	NUMBER OF CASES	MEAN[1] NUMBER OF TRIALS	MEDIAN NUMBER OF TRIALS	S. D. NUMBER OF TRIALS	RANGE NUMBER OF TRIALS	PERCENTAGE OF COMPLETE FAILURES	PERCENTAGE SUCCEEDING IN 25 OR LESS TRIALS
5 and 6	A. Unnamed	28	47.1 ±3.6	69	22.5	8–91	36	14
3 and 4	B. Named	25	28.3 ±3.3	37	22.1	2–76	20	44
1 and 2	C. Animal	27	6.6 ± .6	5	4.7	1–15	4	95

[1] Omitting cases of complete failure.

TABLE 2

Comparison of scores on the series presented second

GROUPS	SERIES PRESENTED SECOND	MEAN[1] NUMBER OF TRIALS	MEDIAN NUMBER OF TRIALS	S. D. NUMBER OF TRIALS	RANGE NUMBER OF TRIALS	PERCENTAGE OF COMPLETE FAILURES	PERCENTAGE SUCCEEDING IN 25 OR LESS TRIALS
2 and 4	A. Unnamed	12.4 ±1.9	6	12.97	1–53	0*	75
1 and 6	B. Named	9.1 ±1.4	6	8.99	1–34	9	82
3 and 5	C. Animal	5.4 ± .8	4	5.7	1–25	4	96

[1] Omitting cases of complete failure.

* Children completely failing the named series were not given the unnamed series.

data for all groups and all sequences are presented in table 4.

The "correct" object in the unnamed series was spontaneously named or described by thirteen of the children. The average learning score for these children on this series (11.9) is significantly lower than the average learning score of 47.1 for all groups on this series. The scores of the children the descriptions are "flat on top," "remember the point that's on it," "the smoothed one," and "like Mount Hamilton." All the children who verbalized the "correct" object in the unnamed series solved the problem.

Several interesting remarks were made by the children about the relative difficulty of the three series. A six year old girl in group I, whose

TABLE 3

Comparison of scores on the series presented third

GROUPS	SERIES PRESENTED THIRD	MEAN[1] NUMBER OF TRIALS	MEDIAN NUMBER OF TRIALS	S. D. NUMBER OF TRIALS	RANGE NUMBER OF TRIALS	PERCENTAGE OF COMPLETE FAILURES	PERCENTAGE SUCCEEDING IN 25 OR LESS TRIALS
1 and 3	A. Unnamed	8.9 ±1.8	3	12.5	1–51	4	83
2 and 5	B. Named	5.6 ± .9	3	6.4	1–27	0	95
4 and 6	C. Animal	2.9 ± .4	2	2.1	1–8	0	100

[1] Omitting cases of complete failure.

TABLE 4

Comparison of scores made on the three series regardless of the order of presentation

GROUPS	SERIES	MEAN[1] NUMBER OF TRIALS	MEDIAN NUMBER OF TRIALS	S. D. NUMBER OF TRIALS	RANGE NUMBER OF TRIALS	PERCENTAGE OF COMPLETE FAILURES	PERCENTAGE SUCCEEDING IN 25 OR LESS TRIALS
1 to 6	A. Unnamed	21.3 ±1.95	16.5	22.6	1–91	15	54
1 to 6	B. Named	14.2 ±1.6	7.5	18.1	1–76	10	72
1 to 6	C. Animal	5.3 ± .4	4	4.8	1–25	3	97

[1] Omitting cases of complete failure.

spontaneously verbalizing the "correct" object (unnamed series) were considered in computing the averages; thus there is probably a greater difference in difficulty between the unnamed and the other two series than is indicated by the comparison of average scores. Examples of the names given the "correct" shape are "the cup," "Old Mother Shoe," "the slide," and "the piece of cake;" and examples of scores on the animal, named and unnamed series were respectively 4, 4, and 6, remarked when solving the unnamed series, "I wish we had the animal game; I can remember the animals." A boy aged five and a half, who was given the unnamed series after the named, said on the unnamed series, "If they had names, that would be fine."

Of the children who solved the

named series, 90 per cent gave the name of the "correct" object when the experimenter asked where the toy had been found. The scores of the children who did not respond with the name were scattered equally above the below the median scores of their respective groups. Twelve per cent of the children said the name of the "correct" stimulus object as they looked at the objects before picking one up (e.g., "Where's Mobie?" "Mobie's going to have it.)". Sixty-four per cent of the children named the "correct" object of their own accord as they picked it up. Thus practically all the children knew the name of the shape having the toy and many of the children actually used this name when solving the problem. It is possible that even if the child did not recall the name of the "correct" object on seeing it, a stimulus object would be recognized more readily as the "correct" one as a result of the differential auditory and proprioceptive stimuli previously received in the naming of that object.

In a comparison of the performance of the boys and the girls, it was found that 55 per cent of the boys' scores fell below the median learning scores. On the other hand, twelve of the girls failed completely to solve one of the three learning problems, as compared with six of the boys. No consistent nor reliable sex difference is indicated.

The relation of chronological and mental age to the learning scores obtained on the three series is indicated by the following rank-difference coefficients of correlation:

NUMBER OF CASES	SERIES (FIRST PRESENTATION)	C. A.	M. A.
28	A. Unnamed	−.39	−.35
25	B. Named	−.72	−.62
27	C. Animal	−.19	−.21

With the effect of chronological age eliminated, the correlation with mental age would be negligible. The relatively low coefficients obtained in the case of the unnamed and animal series, are apparently due in part to their limitations in range of difficulty, the animal series giving a piling-up of good scores, the unnamed series an accumulation of zero scores.

SUMMARY AND CONCLUSIONS

1. Comparisons were made of the learning scores of 80 children between the ages and two and seven years on three series of problems of the multiple choice type. The stimulus objects used for the three series included animal shapes, unnamed 3-dimensional "nonsense" forms, and a similar series of forms with nonsense names.

2. The scores on each series (in terms of number of trials required for learning), exhibited marked individual differences. Correlations with C. A. ranged from −.19 to −.72; with M. A., from −.21 to −.62.

3. A transfer effect was demonstrated from one series to another, as shown by improvement in the performance on successive series.

4. When the three modes of procedure were compared, eliminating practice effect by rotation in matched groups, the median number of trials on the animal series was found to be 4,

on the named series 7.5, and on the unnamed series 16.5 (table 4).

5. Data on complete failures and on the percentage succeeding in a given number of trials, are in support of the conclusion to be derived from (4), namely, that verbalization served as a distinct aid in learning.

6. Through the superiority in the learning of the animal series, the results further indicate the influence of interest factors in learning.

A Genetic Study of Laughter Provoking Stimuli[1]

FLORENCE JUSTIN

LAUGHTER and its causes have been favorite subjects for theorizing for two thousand years. Attempts to explain the phenomenon of laughter probably extended even further back into man's history, but these are unrecorded or unavailable. In the extensive literature that has accumulated, the theories of laughter have in most cases been set forth at great length. With all the writing, the important problems are still controversial and there has been evolved no one principle that has won general acceptance as an adequate explanation for laughter.

One of the first of the theoretical problems to emerge is whether laughter is innate or acquired. In endeavoring to answer this question, Sully (32) calls attention to the age at which it is manifested and mentions the fact that Laura Bridgeman, who was blind and deaf and could not possibly have learned the response, laughed. Goodenough (12) reports that a deaf, dumb, and blind girl studied by the Institute of Child Welfare, laughs. This is more conclusive, for Laura Bridgeman did not lose sight and hearing until two years, but this child has been blind and deaf from birth. That laughter is innate seems to be the generally held opinion of the psychologists of today. Gates (10) would link it with mastery as a strong native impulse. Greig (14) would associate it with the love instinct. Stern (31, p. 126) says, "All these early movements of expression have an instinctive character, there is in them . . . . in distinction from those that follow later, nothing conventional or acquired." Allport (1, p. 253) says that while the act of laughing is inborn, "the range of things that can be laughed at is extended by experience." Woodworth (35, p. 158) states, "One thing is fairly certain: that, while laughing is a native response, we learn what to laugh at for the most part, just as we learn what to fear." This seems to be the generally accepted psychological view.

In the biographical studies of children, considerable material regarding the appearance of the first smile and laugh is to be found. This material is summarized by Sully (32), Greig (14) and by Eastman (7). After comparing dates recorded by Darwin, Preyer, Champneys, Sigismund, Moore, and Shinn, Sully concludes that (32, p. 166) "We find, within the first two or three months both the smile

[1] From the Institute of Child Welfare, The University of Minnesota. Condensed for periodical publication by Mary Shirley.

and the laugh as expressions of pleasure, including sensations of bodily comfort and gladdening sense presentations. We find further, in the reflex reaction of laughter under tickling, which is observable about the end of the second month, the germ of fun, or of mirthful play." More recent observations as by Fenton (9) and Stern (31), and the experimental work of Jones (18) confirm the conclusions of Sully regarding the early development of the smile and laugh.

The further development of laughter during the first three years of life is traced by Sully. Aware that "the new child psychology has not yet produced a methodical record of the changes which this interesting expression of feeling undergoes," (32, p. 186) he turned to the data available. He compiled material from the various biographical studies, compared these with his observations of his own children, and came to the conclusion that "within the first three years all of the main directions of mirth of adults are foreshadowed. Humor itself, which is supposed to come with a maturity of feeling and reflection, begins to announce itself in a modest way during this period." (32, p. 218.)

Watson (34, p. 104) states of smiling, "it begins at birth—aroused by intra-organic stimulation and contact. Quickly it becomes conditioned; the sight of the mother calls it out, then vocal stimuli, finally pictures, then words and then life situations either viewed, told, or read about. Naturally what we laugh at, and with whom we laugh are determined by our whole life history of special conditionings. No theory is required to explain it, only a systematic observation of genetic facts." If such a systematic observation of facts has been made by Watson, a more adequate presentation of data is to be desired. That the smile manifests itself at birth is not upheld either by biographical studies or by experimental work on the early behavior patterns of children. Jones states that the early reflex smile "may be seen as early as the first week. Moore reports a smile on the sixth and seventh day." (18, p. 541.)

Washburn's study deals with the development of the smile and laugh in the infant (33). She observed fifteen children at four week intervals during the first year of life, in a controlled situation where stimulation of laughter and smiling was possible. Laughter occurred later chronologically than smiling, but the author considers it the more primitive form of expressive behavior; smiling, as the child nears the age of one, being much more a learned or conditioned response.

Closely connected with the problem of the instinctive nature of laughter is the question of its universality of manifestation. This is discussed by Sully (32, Chapter 8), authorities being cited to establish it as a characteristic of humans everywhere. Do animals laugh? is another phase of the problem which has come in for considerable discussion. Sully concludes from the observation of Darwin and Robinson, that "the young of the higher apes have something resembling our smile and laugh and produce the requisite movements when pleased. . . . . It further occurs when the animal is tickled." (32, p.

163.) Kohler (22, p. 319) says, "I have never seen anthropoids weep nor laugh in quite the human sense of the term. There is a certain resemblance to our laughter in their rhythmatic gasping and grunting when they are tickled and probably this manifestation is, physiologically remotely akin to laughter. And during the leisurely contemplation of any object which gives particular pleasure (for example, little human children), the whole face, and especially the outer corners of the mouth, are formed into an expression that resembles our 'smile'."

That the expressive movements—of which laughter is one—seem to differ from the other instincts "in that they do not stand in any direct relation to definite consequences," is Koffka's conclusion. (21, p. 115.) According to Allport (1, p. 252) "The greatest obstacle to a satisfactory explanation has been that, unlike other basic forms of behavior, laughter does not serve any known biological purpose." Biological benefits resulting from laughter have certainly been claimed. Sully summarizes the early medical views favoring laughter as an exercise. (32, p. 33.) Darwin says, "Joy quickens the circulation and stimulates the brain which again reacts on the whole body." (6, p. 80.) That laughter hastens the digestive processes has been commonly held. Reports on the inhibiting effects of anxiety, rage or distress are more frequent in the literature than are articles dealing with the stimulating effect of laughter. Alvarez concludes that "much experimental evidence has been gathered to show that emotions can stimulate or inhibit not only peristalsis, but also the flow of the salivary, pancreatic and gastric juices." (2) As yet we do not find psychologists recognizing these physiological benefits as the biological purpose of laughter essential to its explanation.

Eastman considers laughter far from purposeless; there is in play—manifested by laughter—the germ of the sense of humor which is of tremendous value to man. "It is a very inward indispensable little shock absorber—an instinct, as we might call it, for making the best of a bad thing." (17, p. 21.) McDougall advances the defensive aspect of laughter in a slightly different way. To him laughter has been evolved in the human race as an antidote to sympathy or as a protective reaction, shielding us from the depressive influence of the shortcomings of our fellowmen (27).

That laughter has not a biological but a social function is the suggestion set forth by Hayworth. (16, p. 368.) This concept will bring, he believes, "a certain amount of order out of the psychological and philosophical chaos now surrounding the discussion of laughter." "My theory of laughter is that laughter was originally a vocal signal to other members of the group that they might relax with safety." Its use was then volitionally extended to other forms of communications to the group. Darwin, too, recognized the expressive movements as means of communication and held that they are, as such, of importance in our welfare (6, p. 385). That as a means of communication the smile and laugh have a social function is generally acknowledged. Though these explanations do provide a purpose for

laughter they have not been universally accepted as removing the obstacle indicated by Allport.

The most difficult question about laughter, according to Woodworth 35, p. 57) is to tell in general psychological terms what is the stimulus that arouses. To explain the cause of laughter in any terms whatever is evidently a very difficult task—but its difficulty has not deterred many people from attempting it. Through the observation and analysis of laughter-provoking situations, stories and characters, the problem has been approached. The laughable has been differentiated into the ridiculous, the ludicrous, the comic, the witty, the humorous. Certain characteristics of the laughable have been selected and by speculation and analysis theories of laughter evolved from these to explain the cause of laughter.

In 1897, Hall insisted that we must go back of speculation to rebase our theories of laughter causation on wide empirical data. "We are persuaded that all current theories are utterly inadequate and speculative, and that there are few more promising fields of psychological research." (15, p. 40.) The attempts to enter these promising fields are as limited as the theoretical discourses are extensive. Experimental findings relating to the causes of laughter will be briefly reviewed and later the methods employed in these studies will be discussed.

Robinson (28) classified various parts of the body as to ticklishness and emphasized the part played by the social element in the smiling response of young infants. In Hall's findings, information is set forth regarding ticklish areas on the body, and the things children find amusing. The irradiation of sex into many social activities is noted and the relaxing of constraint given as a cause of laughter. Quoting Hall, "This reversionary cause of laughter, which has not hitherto been recognized, we deem one of our most important contributions to the subject." (15) Miss Martin's results indicate that several theories are involved in the comic. Thirty-seven of the 60 subjects reported a feeling of superiority in connection with the picture stimulus, and all but seven reported responses which could be classed under contrast, contradiction or incongruity. The author concludes therefore that contrast is an essential element in the comic (26). The findings of Hollingsworth's study uphold Schauer's theory of the comic. Schauer divides the comic into the objective comic, where the trick is perpetrated on others by natural forces, a third person, or by the victim's own blunder and the subjective comic where we are the object of the trick and feel duped (17). The conclusions of the Scofield study (29) are that no single theory can account for all laughter; that a feeling of superiority tends to be the most fundamental cause of most laughter. Kambouropoulou (19) concludes that the types of humour consistently shown are primarily the personal and the impersonal—though mention is made of laughter at physiological and physical causes. The personal type involves the superiority of the subject, and the impersonal type arises from the perception of incongruity, either of situations or ideas. Mental ability, as

represented by academic standing decreases the proportion of physiological laughter and of laughter at a physical cause, but bears no relation to the personal and impersonal types of humour except by increasing the appreciation of the nonsense jokes. Barry, Jr. (3) reports that incongruity and suddenness play an incidental part in humour; that the situations provoking humour are those which are emotionally weighted for the subject and that it is possible that humour is due to the change from an unpleasant to a neutral or pleasant state. Age variations in laughter-provoking elements and sex differences in laughter response are indicated in the studies of Kimmins (20) and Wynn-Jones (36), but specific information is not given in the brief reports. Enders' study (8) emphasizes the part played by the social element in the laughter of children, and furnishes information regarding the frequency and length of their laughter in nursery school. Jones (quoted by 34, p. 141) lists the situations in nursery school in which smiling and laughing occur and notes that the same stimuli can at one time call forth laughter and at another crying, depending upon the intra-organic condition of the youngster. In Landis's study of emotional reactions, smiling or laughter was a response to 34 per cent of the experimental situations. He explains this in the nature of relief at the tension set up by the situations (24).

Since the early attempt of Robinson to test the degree of laughter responsiveness to tickling, the methods used in the studies reported have been various. Hall collected much data by use of the questionnaire (15). Martin, with comic pictures for stimuli, used undirected introspection, six psychological experimental methods and a questionaire for directed introspection (26). Hollingsworth's experimental set-up consisted of a series of comic jokes (17). Scofield used a standardized scale of jokes and comic pictures in her experiments (29). Kambouropoulou had her subjects keep humour diaries for a week (19). Barry Jr. employed association time reactions in his study (3). Kimmins used funny stories and jokes (20), and Wynn-Jones two series of various forms of wit (36). Enders presented toys to children in an experimental situation (8); the observation of children in nurseryschool was done by both Enders and Jones. Landis's experimental material included pictures, jokes and situations (such as putting the hand into a bucket of frogs and cutting off a rat's head) (23). Washburn (33) by means of peek-a-boo with a cloth, reappearance of the experimenter from under the table and from behind a closed door, rhythmical hand-clapping and knee-dropping, elevator-play, threatening head of child, informal situations and social attempts, endeavored to elicit smiles or laughter in infants.

To enumerate all the various theories of laughter is not our purpose, but a classification setting forth the main types of explanation will be attempted. The first possible classification would be to distinguish between those theories admitting one or more elements to be active in producing laughter and those which, rejecting multiple causation, would explain all laughter by

one formula. This does not, however, prove practicable—few theorisers state as specifically as did Schaupenhauer that "the cause of laughter in every case is —." Often even if a positive statement regarding a single cause of laughter is made some qualification is added which really permits of multiple causation. For instance, Thomas Hobbes' well-known pronouncement that laughter "is the outward sign of a passion which is nothing else but sudden glory arising from a sudden conception of some eminency in ourselves by comparison with the infirmity of others or with our own formerly," would add surprise to the feeling of superiority as a cause of laughter.

The theories of laughter of the many philosophers, poets, and psychologists listed by Greig (14) were classified as carefully as possible. This was a difficult task, since the writers were often obscure and hard to understand and since they discussed different forms of the laughable and used words with little uniformity in meaning. The theories of these writers were compared with those propounded by Sully (32), Hall (15), Sidis (30), Eastman (7), and Gregory (13). From this analysis and comparison emerged the following main theories of laughter causation.

THE THEORY OF SURPRISE AND DEFEATED EXPECTATION

Included here are those explanations which mention surprise—a sudden presentation for which the mind is not perfectly pre-adjusted at the moment —or defeated expectation—a dissolution of a definite anticipation of some particular concrete sequel to what is presented to the mind at the moment, as involved in the production of laughter. Although playing a part in many theories, (30 per cent mention it) few attempt to explain laughter altogether by defeated expectation or surprise.

DEGRADATION-SUPERIORITY THEORY

Under this heading are placed the variations of the 'sudden glory' theory that laughter is due "to some sense of superiority in the laugher," or that laughter gives voice to "man's tendency to rejoice over what is mean and degraded." Thirty-eight per cent of the writers advance this explanation.

THEORY OF INCONGRUITY AND CONTRAST

This division includes those theories which mention as the cause of laughter, presentation of what is at variance with the normal custom or rule, with desirability, sense or reason. This explanation was offered by 42 per cent of the theorists.

FREEDOM OR RELIEF FROM STRAIN THEORY

Explanations of laughter involving a sense of freedom or release from repression or external constraint, from monotony or from logic or reason, advanced by 10 per cent of the writers, are placed here.

JOY, PLEASURE AND PLAY THEORIES

Entered here are those which hold that laughter arises from a sudden accession of happy consciousness, and that the point of view from which things appear laughable is the point of view of play. (Suggested by 23 per cent of the authorities.)

THEORIES RELATING TO THE SOCIAL ASPECT AND FUNCTION OF LAUGHTER

These included those mentioning the smile or laugh as a means of signifying feeling to others; the effect of social relationships upon the manner the laughter is received; the relationship to time and custom, and the aim of laughter. That laughter is "consciously or unconsciously corrective in aim" is held by one group whose modern representative is Bergson. Representative of the other group Dugas maintains that laughter is a-social and a-moral in itself. Thirty per cent of the theories of laughter listed by Greig dealt with this phase of the subject rather than with the cause of laughter.

DEFENSE THEORY

These opinions, of six per cent of the writers, find in laughter "a simple emotional mitigation of failure; "a means to prevent real human loss and make for harmony," or "to protect us from the shortcomings of our fellowmen."

THEORY OF SUBCONSCIOUS GRATIFICATION

Explanations of laughter as the result of suddenly released repression and the physical sign of subconscious satisfaction were advanced by two per cent of the theorists.

PHYSIOLOGICAL OR ENERGISTIC THEORIES

Classified here are those theories that seek to explain the causation of laughter through physiological phenomenon or cerebral mechanics. Eleven per cent offered this explanation. According to Eastman, the classic and supreme expression of this is in Herbert Spencer's essay on "The Physiology of Laughter." (7)

MISCELLANEOUS GROUP

Into this went all the incidental ideas that would not fit into the other classes.

In the above classification incongruity or contrast was the explanation for laughter most often advanced; the superiority-degradation theory was mentioned next often; surprise or defeated expectation as an element of the comic, and the social aspects of laughter received equal attention from the writers in their explanations of the laughable. Other theories were cited less often. On the basis of opinions set forth in the theoretical literature. it is evident that laughter must be explained in terms of multiple causation.

PURPOSE AND METHOD

The purpose of this study was to devise test situations exemplifying the different theories of laughter causation, and to determine the responsiveness of young children to these various types of laughter-provoking stimuli.

Subjects

As subjects 96 children, 12 boys and 12 girls at each yearly age level from 3 through 6 years, were used. The age intervals had a range of an entire year; that is, the 24 children between 3 years 0 days and 3 years 364 days were regarded as 3-year-olds. The children of each sub-group were chosen from homes representing a cross

section of the Minneapolis population in socio-economic status. To be specific the 12 children of each sex at each age were distributed thus: 1 from Occupational Group I, 1 from Group II, 4 from Group III, 3 from Group IV, 2 from Group V, and 1 from Group VI. The preschool children were obtained from nursery schools, day nurseries, and kindergartens about the city, and the 6-year-olds came from the first grade of the public schools.

Intelligence quotients were obtained from 95 of the 96 children. The Minnesota Preschool Test was used on the preschool children and either the Stanford or the Kuhlmann revision of the Binet scale on the 6-year-olds. Table 1 gives the means for each age group.

TABLE 1

Chronological age, mean I.Q., and range of I.Q. for age groups

MEAN CHRONOLOGICAL AGE	I.Q. MEAN	I.Q. S.D.	I.Q. RANGE
3 years 5.45 months	106.83	10.50	77–122
4 years 4.97 months	108.29	11.64	85–130
5 years 5.23 months	111.21	9.34	97–128
6 years 5.65 months	103.70	12.03	76–125

Laughter-provoking situations

Not all the theories were adaptable to experimentation with young children. The theory of subconscious gratification and the defense theory would be difficult to attack experimentally, and the social aim of laughter seemed outside the scope of this study. Consequently, the attempt was made to deal experimentally only with the theories of surprise and defeated expectation; of superiority-degradation; of incongruity or contrast; of play; of relief from strain; and with the social smile as a stimulus.

The devising of situations to set forth these theories was no small task. Even to surprise the child without awakening too great fear requires care in the planning of situations. It is difficult indeed to present incongruous situations to a child whose standards of what is congruous are not well defined. Similarly, one is at a loss to know just what is regarded as degrading, by the child. The devising of superiority and degradation situations presents another problem. As Sully has pointed out (32, p. 136) many if not all amusing losses of dignity logically involve contrariety between what is presented and the normal custom or rule, and again incongruities which are lapses from standard ideas may certainly be regarded as degradations. To get freedom, or relief from strain the child must first be subjected to strain, and yet at the same time, the situation must not be such as would cause him to rebel, or resort to tears or anger. To devise a situation which would present social stimulation without involving other elements was a perplexing problem.

It was originally planned that the theories should be presented in actual situations, in pictures, and in stories. Owing to the length of time required, the stories were omitted, but where the theory permitted, pictures as well as actual situations were used. Situations which might be described as essentially verbal in character were, however, employed. Suggestions were obtained from many sources. Some of the situations are taken from

the literature, and are rather trite illustrations of the theories involved. Such were the man's hat and the baby's bonnet situation used in the incongruity and contrast section; Jack-in-the-box, peek-a-boo, and tickling in the surprise section; and the masks, sitting on the floor, and putting the watch instead of the egg into water, in the superiority and degradation section. The situations used were selected from a considerably larger number. However, just as the devil, in Kipling's poem kept whispering in the artist's ear, "It's pretty, but is it Art?" so it might be asked of each classic example as of the other stimuli, "It's interesting, but does it really involve surprise or incongruity?" To this, one can only reply that, to the best of our knowledge no situations which more truly involve surprise or incongruity for children can, at present, be cited.

By a preliminary experiment, those items which were difficult to control were omitted, and the experimental method of presentation was standardized. This standardized material is set forth in the following:

A. Surprise or defeated expectation situations

A 1 a, A 1 b, A 1 c. The experimental material consisted of three little buckets, a red one containing sand, a blue one containing water (about an inch and a half in each case), and a purple one, which was empty. Each was covered with a paper of the same color, slit and slipped through the bail. These were placed before the subject with the remark, "——, I have here three little buckets, one is red, one is blue, and one is purple. First, you may put your hand in the red bucket—like this—and tell me what is in it." (If necessary, 'Without looking, feel first and then you may look afterwards if you want to'.) "Now put your hand in the blue bucket and tell me what is in it." (Urge as above if necessary) "There was sand in the red bucket, and water in the blue bucket. Now we will find what is in the purple bucket. Put your hand in and tell me."

A 2 a, A 2 b. The material here was a white crepe paper handkerchief. The child was asked, (using child's name), "Did you ever play the game of Where's ——? We play it like this, (throwing handkerchief over child's head) Where's——? Why here she is!" (5 seconds for response) Repeat. (5 seconds for response)

A 3 a, 3 b, 3 c, 3 d. For this situation there were four wooden boxes, five inch cubes, with hinged lids, closed in front with a hook to which was attached a red cord. Three of these contained Jack-in-the-box springs, A3a, with a small doll with a full skirt, A3b with a red rose, A3c with the usual grotesque Jack. The fourth box, A3d, was empty. The boxes all opened fairly vigorously when the red cord was pulled. In A3d, the empty box, a band of elastic fastened to the inner lid and to the back of the box caused it to open when the red cord was pulled. These boxes were placed on the table in front of the child with the remark, "Here are four boxes all the same size, all the same color, and all in a row. They all have little red strings fastened to them. We are going to open them and find out what is in them. First we will open this one and see what is in it. I'll hold the box and you pull the string. What is it?" (Difficulty was encountered in keeping the child from holding the lid of the box down with the one hand while he pulled the string with the other. Frequently, repetitions of, "I'll hold the box, and you pull the string," were necessary.)

The first box was placed back and the next one brought forward with, "Now let's see what is in this box. What is it?" For the fourth box the experimenter said, "There was a doll in the first box, a rose in the second box, and a little old man in the third box. Let's see what is in this." After time for response to this had been given the

child was asked, "Which one did you like best? Point to it."

A 4 a. A yellow and purple ostrich feather obtainable in the ten cent store as a pen holder was shown to the child with the remark, "I have here a pretty feather. It is a yellow and purple feather. It is called a tickle feather, and is used to tickle boys and girls under the chin. Do you like to be tickled?" (moving feather in four continuous strokes back and forth under the child's chin).

In one of the preliminary experiments the child who was playing with the feather while the experimenter recorded, said spontaneously, "I can tickle myself," and did so. As this is a disputed point in material on tickling, thereafter at the close of the tickling by the experimenter the child was given the feather with the remark, "You might see if you can tickle yourself. Can you?"

B. Superiority and Degradation

B 1 a, 1 b. The material for this situation consisted of a little electric stove, on which was a small aluminum pan two-thirds full of water, an old fashioned heavy gold watch, and an egg. Asking the child to come to the table the experimenter said, "—— I have here an egg, and I think I am going to cook it this morning. The egg should go into the water to be cooked, and the watch will show us when the egg has been in the water long enough. Usually, we cook an egg three minutes to have it as most people like it for breakfast. Now I'll hold the watch in my hand, and put the egg on to cook." At this point the experimenter dropped the watch in the water and stood looking at the egg. If there was no response in five seconds, the experimenter exclaimed, "Oh, My! I put the watch instead of the egg into the water! How foolish! We'll have to take the watch out of the water and hope it did not get spoiled."

B 2 a-b-c-d-e-f. Three masks were presented here, a clown face, a red face with protruding ears, and a sheep's face. The child was gotten back to his seat by being told, "Now you may sit down, and I'll show you my masks." As the masks were placed before the child the experimenter continued, "This one (B 2 a) is that of a clown in a circus. This one (B 2 b) is of a red faced man whose ears stick out, and this (B 2 c) is that of a sheep. Would you like to try them on? I'll hold the mirror and you may see which one you like best. (Assistance in trying on the first mask selected was given if necessary) When the masks were first seen, a reaction time of five seconds for each was allowed. In trying on the masks, the response of the child up to 45 seconds was recorded. The trying on of the masks counted as situations B 2 d, B 2 e, and B 2 f, in the order given.

B 3 a, b. "Now I'll put the masks away, and we'll sit down and look at some pictures. There is a chair for you, and here is one for me." Saying this the experimenter missed the chair and sat on the floor. (Five seconds for response) Then the experimenter exclaimed, "Oh Dear! I fell down. These little chairs are hard for big people to sit on." (Response taken for B 3 b)

B 4 a-b-c-d-e-f-g-h. Sitting down on the little chair the experimenter placed the pictures in front of the subject one at a time. The pictures were simple pen and ink drawings made at the Medical Art Shop of the University. The first picture was a copy of one in Edward Lear's Nonsense Book. (25) The others were drawn to set forth situations which are described by the following explanations given to the children with the presentation of the pictures.

B 4 a. "This man has such a long nose that all the people are laughing at him."

B 4 b. "This little boy is giving that little boy a kick in the seat of his pants. Which little boy would you rather be?"

B 4 c. "This little boy is falling down stairs, and he is afraid he will get hurt."

B 4 d. "This man is chasing his hat which the wind is blowing away. Perhaps he will catch it."

B 4 e. "This little baby is crying. I don't know why, but he is crying."

B 4 f. "This boy is crying because he cut his finger."

B 4 g. "This boy is getting a spanking.

His mother is spanking him and he is crying."

B 4 h. "This little boy is getting ready for a bath. He is all undressed and ready for a bath."

B 5 a, 5 b. Holding a street car token between the forefinger and thumb of the left hand the experimenter said, "I have here a token like you give the man to ride on the street car. I am going to take hold of it like this" (apparently taking it with the fingers and thumb of the right hand; the token is instead dropped back into the left hand). Then both fists were presented to the child with the question "Where is it?" The hand the child selected was opened. If he selected the empty hand he was told, "Guess again Where is it?" (B 5 b).

B 6 a, B 6 b. A common mirror was held up before the child with the comment, "You have seen yourself in a mirror, haven't you? Most children have." (B 6 a) Putting the mirror away, a distortion mirror 18 x 28 inches long, supported on an adjustable stand, was turned around and adjusted in height so that the top of the child's head was five inches below the upper edge of the mirror. This was presented with, "Now I'd like to have you see yourself in this mirror. We got it especially for children. Let's see how you look in it." The response during the first minute of exposure only was noted. The child was then asked, "Which mirror do you like best?"

B 7 a-b-c. As the child took his seat the experimenter said, "You know, ———, the other day on the street I saw a man who walked like this, (dragging one foot and limping) (B 7 a) and all the time he kept making a face like this (winking one eye and drawing up the side of the face) (B 7 b) and when he stopped to ask me the time he said, 'S-S-Say. Whwh-what t-t-time is it?' (B 7 c) Just like that. Did you ever see any one do like that?"

C. Incongruity and contrast situations

C 1 a. A doll in the back of whose head eyes had been inserted was shown, attention being called to her normal features before the incongruously placed eyes were revealed. "I want you to see my doll. She is such a nice doll. She has teeth. She can go to sleep. She has real hair with a ribbon on it, and just look! She has eyes in the back of her head." (reaction time) "Isn't that fine?" or, "Isn't she a nice dolly?"

C 2 a. A small wooden doll chair, with legs three fourths of an inch square, on each of which was fastened a doll's shoe, was next presented. The chair was partially wrapped in paper as it was placed before the child. The experimenter said "I'd like to have you see my doll's chair. We like it very much. It has a back and it has arms. It has legs, and (removing the paper) it even has shoes on its legs, (reaction time) "Isn't that a nice chair for dolly?"

C 3 a. Bringing out a man's silk hat and a baby's bonnet, the experimenter said, "I have here a man's hat and a baby's bonnet. I shall put the baby bonnet on my head, and tie the strings under my chin like this. Then we will put the man's hat on you like this, and we will look at ourselves in the mirror like this," (holding a mirror on the table before them). Reaction time was counted from the moment when the baby's bonnet was put on the experimenter.

C 4 a. "I want to show you my toy dogs. I have two of them, a big dog and a little dog, and I have a dog house for them." Saying this, the experimenter placed two small celluloid dogs, one larger than the other, with a dog house on the table. "There is a great big door for the big dog to go through (putting the larger dog into the house through the big door) and right beside it a little door for the little dog (putting the smaller dog half way between the two doors. Reaction time. (Is that the way you would make a dog house for them?")

C 5 a-b-c-d. Of the four pen and ink pictures here shown, one was a copy from the Edward Lear Nonsense Book, and the others are described by the forms in which they were presented to the children.

C 5 a. "This man is sitting backwards in his chair with his feet up in the air. Have you ever seen any one sit that way?"

C 5 b. "This man is walking around balancing a teapot on his nose. Is that the way to carry a teapot?"

C 5 c. "This horse is drawing a milk

wagon I think. It is a rainy morning so he is carrying an umbrella so he won't get wet. Did you ever see a horse carrying an umbrella?"

C 5 d. "This cow is playing the piano while that man is milking her. Did you ever see a cow play the piano while she was being milked?"

D. The social smile as a stimulus

Still holding the portfolio of pictures in her lap the experimenter looked up and said, "You know, ——, (smiling five seconds) when I waked up this morning and looked out of the window, it was raining," (or sunshiny, or cloudy, as the case might be) (laughing three seconds), "Just think of that! It was raining!" (laugh and smile five seconds)

E. Relief from strain situations

E 1 a, E 1 b. A chalk line two inches wide and six feet long was drawn on the floor previous to the experiment. The child was told, "The next game we will play will be walking this line. You can walk a line without falling off, can't you? Well, in this game you are to carry this little parasol over you with one hand, and you are to carry this potato on the spoon in front of you with the other hand." The experimenter stood at the other end of the line and said, (E 1 a) "All ready? Go!", and kept urging, "Keep on the line. Hold the parasol over you, Keep the potato on the spoon in front of you." (E 1 b, response on finishing)

F. Play situations

F 1 a-b-c-d. Verbal play. The first verse used had been very mirth provoking in the nursery school with groups of children, the previous year. The experimenter said, "Sit down here and I'll read a verse to you. It is called 'Picnic', and is about a mother who took some children out for a picnic and when it came time for lunch she told each one what to do to get the meal ready."

F 1 a. "Ella, fella
Maple tree.
Hilda, builda
Fire for me.
Teresa, squeeza
Lemon so.
Amanda, handa
Plate to Flo.

Nora, pour a
Cup of tea.
Fancy, Nancy!
What a spree!"

Smiling at any time during this presentation, as well as that beginning within ten seconds after it was counted. The same holds true for the three other verbal play situations.

F 1 b. "Ella Fella" was repeated as fast as possible.

F 1 c. The child's own name was substituted in the following verse, said slowly:

"Robert-bom-barbert,
Tee elegant targert,
Tee legged, toe legged,
Bow legged Robert."

F 1 d. "Robert" repeated rapidly.

F 2 a. The Jumping-Jack used here was a Dutch doll of not particularly grotesque appearance. The toy was hung on something and the child told, "Here is a Jumping-Jack. If you pull the string it will dance for you." If necessary a demonstration was given in making the doll dance. Response was observed for 25 seconds from the time the child took the string.

F 3 a. The flicker top was a ten cent store toy, with a central knob, which when spun caused a circular movement of an inner vari-colored disk. This was placed before the child and spun, the experimenter saying, "If you spin this, it makes the colors come and go." The top was stopped and the child told, "You may do it." The child's response was observed for 45 seconds from the time he took the top.

F 4 a. For the tower building situation, a nest of six blocks, the largest of which was a five inch cube, was used. The experimenter said, "I have here some blocks, and I am going to build a tower like this," (putting one block on another). "Now that it is all finished you may knock it down. That's right, Give it a push." The child was urged if necessary, and in one case the experimenter assisted the child to knock the

tower down. Any response occurring after the child touched the tower was recorded.

F 5 a. An eight tube xylophone was placed before the child with the comment, "This xylophone will make nice sounds if you strike it with this little hammer," (running down the scale). Any response occurring within 45 seconds from the time the child took the hammer in his hand was recorded.

Experimental procedure

Each item of the experimental material was presented separately to the child, who was seated at a low table. When not being presented, the material was kept out of sight. Toys, the response to which was not recorded, were given to the child to busy himself with while the experimenter was recording responses. With the exception of the social stimulation situation, the experimenter throughout endeavored to maintain an interested but unsmiling countenance.

It was found that in practically all instances, responses came within ten seconds of the presentation, if at all. Ten seconds was, therefore, decided upon as the time limit. If no response occurred in the first ten seconds after presentation, the next situation was presented. If response occurred within this interval, exposure was continued until it ceased, and was followed by a five second interval of non-response. In a few instances, the time was reduced to five seconds. These exceptions have been noted. In certain of the play situations, prolonged smiles necessitated limiting the time for which response would be recorded. Such limitations have been noted, as have any other deviations from the general rule.

It is known that the order of presentation does have some effect on the response, though just what the effect is, has not been made clear. In order to prevent the situations representing any one theory from having the advantageous position, the six main divisions were rotated in presentation. A simple rotation whereby the division presented first was transferred to the end of the series for the next presentation, was used. As each age group was divided into four parts containing six children—upper class girls, lower class girls, upper class boys, lower class boys, in these groups, at every age, each of the six main divisions of situations had a first presentation.

RECORDING OF DATA

The record blank contained space for the recording of laughter, of bodily activity, and of speech manifested upon the administration of the various stimuli. The laughter was measured by means of a stop-watch, in seconds of smiles and of laughter. Since the study was concerned primarily with the laughter response, greatest stress was given to the recording of seconds of smiling or laughing. Emphasis was next given to the speech reactions, which were recorded word for word; the bodily movements received scant attention.

Observational error

The accuracy of the experimenter's record of the length of the laughing response was checked by having two other observers keep records simultaneously. Each observed and recorded seconds of response for one child at each age. Pearsonian corre-

lations between these supplementary records and those of the author averaged .95 for one observer and .83 for the other.

Age differences in laughter response

The results were treated in two ways: the mean length of the smiling and laughing response was computed in seconds; and the percentage of children responding with signs of mirth were computed for each situation. Since in a study of laughter a second of laughing is logically of greater value than a second of smiling, the time scores were weighted by giving a second of laughing a value of 2 and a second of smiling a value of 1.

The weighted time scores for the different age groups are given in table 2 and the percentages of response in table 3. In total responsiveness both scores show the same age trend,—an increase in display of humor from three to five years, and a decrease at six years. Time score for the 5-year-olds is significantly higher than for any other age group; the ratio of the difference to its sigma is above 3.0. Differences among the other age groups

TABLE 2

Mean weighted time in seconds of laughter response of 3-, 4-, 5-, and 6-year-old children to total situations and to each of the six main divisions

SITUATION DIVISIONS	3-YEAR	4-YEAR	5-YEAR	6-YEAR
A. Surprise-defeated expectation	4.30	5.70	6.59	5.24
B. Superiority-degradation	2.67	3.72	5.40	3.85
C. Incongruity and contrast	3.91	5.53	9.88	7.41
D. Social smile as a stimulus	4.17	8.08	9.96	5.08
E. Relief from strain	2.67	2.42	3.54	1.73
F. Play	4.97	6.87	8.86	6.52
Total M	3.53	4.86	6.81	4.97
Total S.D.	2.19	1.66	2.12	2.01

TABLE 3

Percentage laughter response of 3-, 4-, 5-, and 6-year-old children to total situations and to each of the six main divisions

SITUATION DIVISIONS	3-YEAR		4-YEAR		5-YEAR		6-YEAR	
	S. and L.	L.	S. and L.	L.	S. and L.	L.	S. and L.	L.
A. Surprise-defeated expectation	85.83	11.67	93.75	8.33	94.17	23.75	90.41	10.83
B. Superiority-degradation	40.67	9.83	53.17	7.00	69.17	19.33	62.67	10.83
C. Incongruity and contrast	56.25	15.63	72.92	11.46	89.06	33.85	84.38	28.64
D. Social smile as a stimulus	91.67	12.50	95.83	4.17	91.67	20.83	91.67	8.33
E. Relief from strain	47.92	4.17	52.08		54.17	4.17	41.67	2.08
F. Play	56.25	4.17	65.10	5.73	80.73	22.40	72.92	4.69
Total	54.86	10.03	66.13	7.41	78.32	22.22	72.30	12.19

are not statistically significant. The greater responsiveness of the 5-year-olds is also manifested in each of the six categories.

Age differences in the effectiveness of the surprise, the social smile, and the relief from strain categories are small; incongruity, superiority, and play situations become more potent stimuli to laughter as age increases. For the most part the different situations held the same rank in effectiveness at all ages. The social smile was the best stimulus to smiling or laughing, surprise held second place, incongruity third, play fourth, superiority fifth, and relief ranked sixth in eliciting laughter. Although these rankings are interesting and suggestive as to the relative effectiveness of different types of stimuli in provoking children to laughter, they must not be taken too literally, since it is likely that the experimental situations more effectively set forth the theory in some categories than in others; that situations classified under surprise more truly involved surprise than incongruity situations involved incongruity.

Responses to specific situations

Of the ten situations in the division of surprise and defeated expectation, tickling called forth 100 per cent response from 3, 4, and 5-year-olds, and 96 per cent from 6-year-olds. Although it was the most effective stimulus on the whole, the grotesque jack received longer laughs from the 3 and 6-year-olds. In the division called superiority-degradation the mirror situations and the trying on of masks were equally effective at all ages. The funniest picture for the three younger ages was that of the long-nosed man, and for the 6-year-olds was that of the boy being kicked. Under incongruity and contrast the man's hat and the baby's bonnet obtained the most laughs from all ages, although 3-year-olds were equally amused by the doll with eyes in the back of her head, and the 5-year-olds by the dog's house. In the relief situation, the conclusion of the walk with parasol and potato brought more smiles than did the line-walking. In the play situations 3-year-olds gave the highest response to the xylophone, 4-year-olds to the flicker top, and 6-year-olds to the jumping jack. Surprisingly enough, knocking down the tower was more diverting to the 5 and 6-year-olds than to the younger groups.

TABLE 4

Mean response in seconds at the four age levels to actual situations, pictures, and verbal presentations

AGE	SITUATIONS	PICTURES	VERBAL PRESENTATION
3-year	4.73	.91	1.56
4-year	6.41	1.65	2.05
5-year	8.36	3.59	4.22
6-year	6.36	2.64	2.10

TABLE 5

Mean laughter response in seconds at the four age levels to situations in which the child participated, and to those in which he did not

AGE	PARTICIPATING	NON-PARTICIPATING
3-year	5.91	1.35
4-year	7.91	1.89
5-year	9.68	4.06
6-year	7.26	2.86

Relative effectiveness of actual, pictured, and verbal presentation

In tables 4 and 5 the situations are divided respectively on the basis of the manner of presenting stimuli, and on the extent of the child's participation in the situation. At all ages the actual situations provoked longest laughs; verbal "jokes" were next most effective with all except 6-year-olds, and pictures were least heartily laughed at. At all ages the children laughed longer at situations in which they participated, such as trying on masks, mirrors, man's hat and baby's bonnet, than at the situations in which they did not participate, such as the egg and watch, falling off the chair, and looking at pictures.

Relation of laughter response to sex

The mean seconds of response and the percentage response of boys and girls to total situations, and to each of the six main divisions of situations are set forth in table 6.

The mean seconds of total response is greater for the girls than for the boys. In the six main divisions of situations, the girls maintain the lead in mean length of response, except in the superiority-degradation and the relief-from-strain situations. The girls have the greater percentage response with smile or laugh to total situations and to each of the six main divisions; however the boys responded to a greater percentage of situations with actual laughter. Apparently the girls smile more than the boys; the boys laugh more than the girls.

TABLE 6

Laughter response of boys and girls to total situations and to each of the six main divisions. Mean seconds of response and percentage response

SITUATION DIVISIONS	MEAN SECONDS OF RESPONSE		PERCENTAGE RESPONSE, SMILE AND LAUGH AND LAUGH ALONE			
			Girls		Boys	
	Girls	Boys	S. and L.	L.	S. and L.	L.
A. Surprise-defeated expectation	5.50	5.38	94.17	14.37	87.92	12.92
B. Superiority-degradation	3.82	4.01	58.83	10.16	54.00	13.33
C. Incongruity and contrast	7.08	6.30	79.17	21.61	72.14	23.17
D. Social smile as a stimulus	7.33	6.29	97.92	10.43	87.50	12.50
E. Relief from strain	2.44	2.76	50.00	3.13	47.92	2.08
F. Play	7.58	5.95	71.61	9.12	65.89	9.38
Total	5.19	4.89	70.68	12.23	65.12	13.70

Means and sigmas and percentage responses for the sex groups were calculated for each of the 54 individual situations. In each division, the most effective situation for one sex was also most effective for the other. The girls much more than the boys laughed at the exclamation after the watch was dropped into water, and at trying on the clown and sheep masks; the boys much more often than the girls responded to pictures of a boy falling and of a boy getting spanked. The

variability of the boys is greater than that of the girls, their sigmas being the larger in nearly three-fourths of the situations. Aside from variability the comparison of the boys and girls leads to the conclusion that differences in laughter response due to sex are not great.

Relation of laughter response to occupational status

The mean seconds of response, and the percentage of response, of upper and lower occupational groups to total situations and to each of the six main divisions, are set forth in table 7. The greater responsiveness of the children of the upper occupational group is manifested rather consistently.

TABLE 7

Laughter response of upper and lower occupational groups to total situations and to each of the six main divisions. Mean seconds of response and percentage response

SITUATION DIVISIONS	MEAN SECONDS OF RESPONSE		PERCENTAGE RESPONSE, SMILE AND LAUGH AND LAUGH ALONE			
			Upper		Lower	
	Upper	Lower	S. and L.	L.	S. and L.	L.
A. Surprise-defeated expectation	5.67	5.18	93.75	16.04	88.33	11.25
B. Superiority-degradation	4.46	3.37	58.33	14.16	54.50	9.33
C. Incongruity and contrast	7.27	6.12	76.04	25.78	75.26	19.01
D. Social smile as a stimulus	6.94	6.69	91.67	12.50	93.75	10.43
E. Relief from strain	2.91	2.29	51.04	4.17	46.88	1.04
F. Play	7.09	6.45	71.09	11.20	66.41	7.29
Total	5.48	4.60	70.45	11.54	66.05	10.53

In the means of the 54 individual situations, the trend of greater response for the upper occupational group is in evidence. It is marked in the smiles and laughter with which the picture of the boy falling downstairs, the picture of a boy with a cut finger, and the picture of a man with a long nose, were viewed by the upper class children. The experimenter's exclamations on dropping the watch in water, and upon sitting on the floor, likewise were greeted more hilariously by them. The wrong guess of the coin they were better able to face with a smile. The semi-serious accidents, whether occurring to themselves or to others are seemingly viewed more lightly by the upper class children. The situation in which the response of the lower group was markedly ahead of the upper was seeing themselves in an ordinary mirror. Their evident greater pleasure in the common mirror is difficult to explain; that mirrors are outstandingly less frequent in the lower class homes seems doubtful.

Relation of laughter response to intelligence

To determine possible relationship between intelligence and laughter correlations were computed between I.Q. and both length and number of responses at each age. The coeffi-

cients were in general low, but positive. They were higher at the younger ages, those for length of response decreasing from .40 at 3 years to .23, .24, and .12 at 4, 5, and 6 years respectively. The relationship between I.Q. and length of laughing was highest for the division of incongruity.

DISCUSSION

In a truly comprehensive genetic study of laughter-provoking stimuli, the logical point of departure would be the new-born infant. However, the study of the early manifestation of the reflex smile or laugh as an expression of physical comfort and pleasurable consciousness; the study of the emergence of the social smile, and the subsequent differentiation of the response and extension of the stimuli which arouses it, prior to the age of three, has been outside the province of this investigation.

That by the age of three, the child has learned to respond to widely divergent types of stimuli is revealed by these data. All the main divisions of experimental situations, devised to set forth the various theories of laughter, elicited some response from the three year old group. Sully's conclusion that by the age of three, all the adult forms of mirth are foreshadowed in the child would seem to be substantiated by the findings of this study.

When, through the use of the experimental situations, we seek to trace the development of the laughter response in the immediately succeeding years, we are impressed by the marked enlargement in the number of situations which provoke laughter in the four and five year groups. Not only is the field of the laughable being constantly extended, but this takes place, not by a sudden development of one line or increase in the effectiveness of one type of situation, but rather by a gradual extension of response to all the types of stimuli considered. The relative effectiveness of the main divisions of situations does not change markedly or consistently with age.

The enlargement of the field of laughter-provoking objects is seemingly an outcome of the whole process of mental growth. Sully points out that the awakening of the "self feeling" gives rise directly to certain forms of laughter. The consistently greater response to the situations in which the child himself participates, would indicate that "self feeling" may enter into the laughter-provoking effectiveness of the stimuli. To the extent that the child is able to identify himself with others and enter emphatically into situations presented, self-participation should decrease in importance. At all the ages studied, the difference in response to participating and non-participating situations is in favor of the situations in which the child participates. The difference is, however, less marked in the fifth and sixth years than in the third and fourth.

That a certain level of intellectual development must be reached for the appreciation of the more complicated mirthful situation seems probable. Sully says "The first amusement at the sight of the ill-matched, the inconsequent, implies the advance of an analytical reflection up to the point of a dim perception of relations. A large part of the extension of the field

of the laughable, depends upon this intellectual advance, a finer and more precise apprehension of what is presented, in its parts and so as a whole, as also in its relations to other things." The relationship between length of laughter response to the incongruity division and I.Q. is perhaps most clearly indicated in this study, though the correlations of I.Q. and response to the other divisions and total situations were largely positive. A possible trend of decrease of importance of I.Q. with age is suggested by the correlation of mean seconds of laughter response to total situations r being +.40 for the three year olds, +.23 and +.24 for the four and five year olds and +.12 for the six year olds. This may, however, be due to the situations presented. They may be of such a nature that practically all the six year children have the requisite mental level to comprehend them. Perhaps more complicated situations might at this age level show a higher relationship of laughter response with intelligence.

Upon the subject of mental development and the part played by intellectual factors in the production of laughter, the response to the three types of situations presented may throw some light. The verbal presentation of this experiment cannot be said to have involved symbolism; it was largely word play with sound and suddenness as predominating characteristics. The pictures may, however, be regarded as having symbolic meaning. The forward shift, in the sixth year, of the laughter response to the pictorial presentation, might indicate that the load which was previously carried by actual situations is being somewhat shifted to symbolic processes. A large part of the developmental enlargement of what is laughable may depend upon this intellectual advance.

That the development of laughter involves a transition or change in the effectiveness of the objects provoking laughter seem evident. The response of the six year olds to tickling, for example, falls below that of the three year group, while to certain other objects,—empty box, picture of boy getting spanked—it exceeds even that of the five year olds. This latter is rather surprising, for the general trend is a decrease of laughter response in the sixth year. That the experimental situations did not provide for situations which were laughter-provoking for the more advanced mental levels is a possible explanation of this decrease.

It is also possible that the laughter response may undergo a general toning down. The subduing effect of the first grade of the public schools might be suggested as a possible explanation of the drop of responsiveness of the six year olds. The children of this age level all attended the first grade of the public schools and the majority of them were tested in the school buildings, being taken from the classes for the experiment. The younger children were practically all tested in nursery schools and kindergartens where less attempt is made to control the spontaneous laughter. In the first grade the child learns that he is not to laugh at what happens *in school.* Sully says, "A child soon finds out that a good deal of his rollicking

laughter is an offense, and the work of taming the too wild spirits begins." (5, p. 193.) That this occurs with the entry into the first grade seems possible and may account for the decrease in the laughter response of the six year old children studied in this investigation.

Sex differences in laughter response are not statistically significant. That boys laugh more often than the girls, may be due to innate differences or to the social pressure which imposes more "lady-like" standards upon the girls. If the latter is the case, the sex differences should, with continuance of social pressure, increase in size. In the three year group the girls laughed nearly twice as often as the boys, and their laughter response in seconds is greater. The four year old boys in comparison with the girls laughed at a greater number of situations, and their laughter response in seconds is likewise greater. In the fifth year the boys and girls laughed at exactly the same number of situations, but the laughter response in seconds is considerably larger for the boys. The six year old boys laughed more than twice as often as the girls, and the laughter response in seconds is over twice as great. Though not entirely consistent, these results indicate that the laughter response of girls may be repressed into smiling by social pressure.

If smiling is regarded as a means of communication the findings of this study fit in well with those of the McCarty study of language development, which were in favor of the girls (4).

Since the laughter response is positively correlated with I.Q. the differences in intelligence which characterized the sex groups in this study should be mentioned. The mean I.Q. for the girls was 110.4, and for the boys 104.6.

The differences in I.Q. may perhaps enter into the small but consistent occupational differences in laughter response in favor of the upper group. The mean I.Q. of the upper occupational group was 109.4, of the lower group 105.7. The greater responsiveness of the upper group might also be explained on the basis of a more restricted and inhibiting environment of the lower group. Life is for them, perhaps, a more serious affair. The differences show no consistent trend to increase or decrease with age.

In regard to the essential element of a laughter-provoking situation for young children, now as thirty years ago "The one thing that is always present that provokes laughter, to suppress which is to suppress laughter, a variation of which has an immediate effect on the intensity of the emotion of the ludicrous, is still to be found." (3) The responsiveness of children to such a variety of situations, selected to set forth the various theories of laughter, substantiates the statement that the production of laughter is a very complex phenomenon and that any attempt to give it a single cause or explain it by a single formula fails.

The effect of social participation on the laughter response to situations has not been dealt with in this investigation; the effect on response of the progressive building up of the humorous situations has likewise not been determined; findings on these subjects should add to the understanding of the genetic development of laughter.

With the course of development of laughter relatively untouched by previous investigations, the evaluation of the results of this study on 3, 4, 5, and 6 year old children is difficult. The findings can certainly not be regarded as conclusive. Further investigations are needed to determine the transitions that take place at these ages, and at preceding and subsequent ones, and to provide a more adequate and complete picture of the development of laughter. Perhaps when this is available there will likewise be discovered the essential element in a laughter-provoking stimulus, which will serve as a touchstone to solve the intriguing riddle of laughter.

SUMMARY OF FINDINGS

1. In responsiveness of three, four, five, and six year old children to laughter-provoking stimuli, the general trend as revealed by this study, is an increase in responsiveness to the fifth year and a decrease in the sixth. This trend is apparent in total response and in responses to the six main divisions devised to embody the various theories of laughter causation, both in mean seconds and in percentage of response to situations of the four age groups.

2. This change with age is not due to sudden shift in the relative effectiveness of one type of situation in eliciting response. Despite age increase and subsequent decrease, the percentage responses to the main divisions of situations do not markedly change their relative positions. An increase with age in the effectiveness of incongruity to produce lengthy response is indicated.

3. A study of the 54 individual situations leads to the following conclusions: (a) Marked variability in response to laughter-provoking stimuli is shown within each of the four age groups. (b) While individual situations show deviations, the increase of laughter response with age to five years, and the decrease in the sixth, is the trend most generally shown.

4. Of the three forms of presentation, actual situations were, in mean seconds of response, the most effective at all age levels. At three, four, and five years, the verbal presentation was next in effectiveness, and the pictures were least effective. At the sixth year, pictorial presentation was more effective than the verbal.

5. At all age levels, the mean seconds of response to situations in which the child himself participated was greater than the response to those situations in which he did not participate.

6. In general, though the girls are more responsive to laughter-provoking stimuli than the boys, the differences are not marked. Apparently, girls smile more than boys; boys laugh more than girls. Boys are more variable.

7. The greater responsiveness of the children in the upper occupational group in contrast with the lower is manifested consistently, though not markedly.

8. A positive relationship between I.Q. and laughter response is evident in this study. The relation of seconds of response to incongruity and I.Q. is perhaps most clearly indicated. Correlations with total seconds of

response at the various age levels suggest as a possible trend a decrease with age in the relationship between length of laughter response and I.Q.

9. A survey of the verbal responses and bodily movements produced by the laughter provoking stimuli indicated that the situations exemplifying the six main theories of laughter causation did involve, at least for some children, the elements they were designed to set forth.

10. It would be impossible to state that the elements which these situations endeavored to present were recognized as such by all the children, even by those who laughed. It would likewise be impossible to say that all those who recognized the elements laughed.

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The Preschool Child's Use of Criticism

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ONE function of children's language listed in Piaget's classification is that of criticism. An investigation of this function is the subject of this study.

Approximately twenty thousand sentences spoken by children had been gathered in the course of another investigation. From these records of children two to six years old, all sentences expressing criticism of another child or of an adult were culled and analyzed in order to study the development of this use of language by little children. There were 325 such criticisms found. In comparing children at different ages a child was counted as two years old if his exact age lay between eighteen months no days and twenty-nine months thirty days inclusive. Another series of one hundred criticisms made by adults was gathered with the help of one of my classes in Teachers College, University of Hawaii to serve as a comparison with the main series.

There were very few criticisms made by the two-year-old children but there was only about one third as much material examined from children of this age as there was of each of ages three, four, and five and very little material, about one tenth as much, was available for children from sixty-six to seventy-two months of age. The more exact comparisons of children were therefore made between the three and five year olds for the most part.

Favorable criticisms composed a very small portion of the total, about eleven percent of them all. The difference between the proportion at three and five is insignificant but the four year olds used a number much smaller than at any other age and significantly less than did the five year olds. These criticisms—thirty-six in all—commented favorably on some person's dress three times, in eleven cases the person's actions or Hallowe'en mask or some other product of his skill was considered funny—funny, here being used with the idea of its desirability—in the remaining cases the person, his action, work or possession was said to be right, nice, cute, big—used as praise—, darling or good. Fifteen or 42 percent of these were spoken directly to the person criticised in contrast to only twenty-nine percent of all the criticisms to be thus directed. It would seem that even such young children have found it to be more discreet to direct favorable than unfavorable criticism to the person concerned.

The purpose of unfavorable criticism with the youngest children apparently was primarily to gain the assistance of some other person in a situation that was beyond their power of control. It was usually directed to an

adult in the hearing of the child criticised and partook of the nature of tattling. This was true of every one of the unfavorable criticisms of the two year olds.

The percentage of criticism made directly to the one criticised increased with age. The difference of 19 per cent between those of four and five years old is almost four times its probable error.

Apparently the younger children did not think their own criticisms would be of any use in obtaining their desires from the person criticised. They might ask or demand of him the object snatched away or the action desired but criticism was of no particular use except in securing the aid of another usually an adult.

At three, there was a beginning, five cases, of calling names or epithets as a relief to injured feelings that was directed to the culprit such as "You are naughty," "You are a crazy cat," "You're junk," "She's a lazy bone." This increased with the older children who also used a wider range of adjectives in describing the undesirable conduct of their companions to themselves or to others. They also commented in this fashion upon the conduct or personality of other children even when the conduct had very little effect on themselves. This type of criticism is included under the heading

CRITICISMS

	MADE BY CHILDREN AGED									
	2 years		3 years		4 years		5 years		66 to 72 months	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Number of criticisms	12		82		90		132		9	
Favorable criticisms	2	17	10	12	3	3	20	15	1	11
Unfavorable criticisms	10	83	72	88	87	97	112	85	8	89
Main consideration is effect on self	10	83	40	49	50	56	40	30	4	44
Interference:										
With self	8	67	37	45	38	42	37	28	4	44
With others			9	11	5	6	4	2	1	11
Total of interference	8	67	46	56	43	48	41	31	5	56
Failure to:										
Do as *I* wish			1	1	3	3	3	2	0	
Conform			7	9	13	14	14	11	1	11
Total failure to conform	1	8	8	10	16	18	17	13	1	11
Personal traits:										
Complained of because of effect on self	1	8	2	2	9	10	0	0	0	
Total personal traits	1	8	5	6	11	12	9	7	0	
Lack of skill or knowledge	0	0	13	16	17	19	45	34	2	22
Criticisms made:										
Directly to one criticised	2	17	17	21	19	21	53	40	3	33
Of which favorable	2	17	5	6	1	1	6	5	1	11

of unfavorable personal traits in the table. It composes but a small proportion of the criticism at every age.

By far the largest proportion of criticisms made by the children before five years is of interference with themselves or their possessions; such complaints as "That boy is mussing my sand all up," "You're spoiling the game," "He won't let me play," "He called me names," "You are always getting mine," "D. is right on your heels all the time," "C. hurt my sore arm," "E. stole my ball," are all listed under this heading. In most cases complaints are made only when some child interferes with the speaker but in a few cases particularly at three years complaint is made in behalf of another child; for example, "Daddy burned B's paper," "You'll make him deaf," (if you blow in his ear) "He hurt her," "This boy knocked A. on the nose."

The largest category of criticisms of the five year olds is that of another's lack of knowledge or skill or failure to produce a satisfactory result sometimes made to the child directly in an attempt to correct his error but more often apparently for the satisfaction of demonstrating the speaker's superiority. Examples of these are "Your dog has three legs," "You don't know how," "He can't tell names," "You swing me crooked," "He can't sing," "Such a dumb face," "Can't even blow it," "That's not your right hand," "You folks making this wrong."

COMPARISONS OF CRITICISMS

	MADE BY CHILDREN THREE AND FIVE YEARS OLD					MADE BY ALL CHILDREN STUDIED AND BY ADULTS				
	3 years		5 years			All children		Adults		
	Number	Per cent	Number	Per cent	Difference	Number	Per cent	Number	Per cent	Difference
Number of criticisms	82		132			325		100		
Made directly to person criticised	17	21±3.7	53	40±3.5	19±5.1	94	29±2.1		26±3.6	−3±4.2
Favorable criticisms	10	12±2.9	20	15±2.6	3±3.9	36	11±1.4		23±3.5	12±3.8
Unfavorable when main consideration was effect on self	40	49±4.5	40	30±3.2	−19±5.5	144	44±2.3		16±3.0	−28±3.8
Criticising:										
Interference with self or others	46	56±4.5	41	31±3.3	−25±5.6	143	44±2.3		5±1.8	−39±2.9
Failure to conform with social usage or desires of self or another	8	10±2.7	17	13±2.4	3±3.6	43	13±1.5		28±3.7	15±4.0
Undesirable personal traits	5	6±2.2	9	7±1.8	1±2.8	26	8±1.2		31±3.8	23±4.0
Lack of knowledge or skill	13	16±3.3	45	34±3.4	18±4.7	77	24±1.9		13±2.8	−11±3.4

The remaining type of criticism was that of failure to conform to the wishes of the one making the criticism as "You don't give me anything," "Nobody comes to buy" or more frequently, to conform to rules of conduct or the usage of the group such as "W. told bad stories," "He didn't say present," "Her say debbil," "You bof spilled," "You didn't do what mama wanted," "They aren't getting into line."

Criticisms of interference, failure to conform and personal traits were each separable into two divisions according to whether or not they had been made primarily because of the effect on the speaker of the action criticised. This consideration was most marked with the youngest children and a significant difference of nineteen per cent which is more than three times its probable error was found between the amount of such criticism made by three- and five-year-old children.

The proportions of all criticisms made by all the children from two to six years were also compared with the series of adult criticisms. The adults showed no difference in the amount of criticism directed to the person himself (though a higher percentage of criticisms thus directed were favorable) but criticism not so directed was more in the nature of "talking behind their backs" than of tattling and was not within hearing of the person criticised as was most of that made by the children. The adults' criticism of interference was almost negligible and significantly less in proportion than the children's while the significantly larger proportions were of undesirable traits and of failure to conform. Of the latter type one particularly large subdivision was that of dress. Of the one hundred criticisms collected, nineteen commented unfavorably on dress or makeup and nine favorably while only nine of the 325 child criticisms mentioned dress either favorably or unfavorably. The criticisms of personal traits were much more abstract and used adjectives almost entirely rather than frequent nouns as did the children's criticisms of this nature. Only five of the thirty-six criticisms of this type were made directly to the person concerned and they probably were considered to be of a less serious nature than those not so directed such as changeable, "got your nerve," "you're both hot-tempered" as compared with snobbish, sarcastic, rude, frivolous, lazy, careless, lacks self-respect. The group of criticisms of lack of knowledge or skill was significantly less in proportion than in the case of the children, only thirteen cases in all, of which six complained of lack of skill in some game. All but one of these were unfavorable and were made to the blunderer himself in contrast to not one unfavorable made to the person criticised for lack of knowledge or skill in other lines. Is it possible that our emphasis on good sportsmanship in games and sports has made it possible for our friends to dare to make their criticisms in this field to us directly where it would supposedly be of most value? One improvement the adults made was an increase of twelve per cent which was three times its probable error, in the proportion of favorable criticisms.

SUMMARY

1. A study of the criticisms made by children of two to six years old showed four types of unfavorable criticisms made;—interference with self or possessions, failure to conform to wishes or social usage, lack of knowledge or skill, and undesirable personal traits.

2. The amount of criticism found in records of complete conversations increased slightly but regularly from two to five years.

3. At first criticism was directed to another than the person concerned apparently for the purpose of securing help in a difficult situation and partook of the nature of tattling.

4. A significantly greater proportion of criticisms was made at five than at three years old, directly to the person criticised.

5. At every age the unfavorable criticism greatly exceeded the favorable.

6. The most frequent complaints were of interference and lack of knowledge; the former decreasing and the latter increasing significantly with age from three to five. Failure to conform and undesirable personal traits were complained of most frequently at four but the difference at different ages was not significant.

7. Most of the criticisms made by children were made primarily because of their effect on the speaker, but the percentage of such criticisms lessened significantly from three to five years.

8. A series of criticisms made by adults and collected for the purpose of comparison showed a significant increase in the proportion of criticism of personal traits, of dress, of failure to conform and of favorable criticisms with a significant decrease of criticisms of lack of knowledge or skill and of interference.

9. But there was no significant difference in the amount of criticism directed to the person criticised; that made to another however was of the nature of "talking behind their backs" rather than of "tattling."

A Study of Emotional Instability in Nursery School Children

Mary A. M. Lee

"NERVOUSNESS" is a term that needs elucidating. For some it means muscular activity of a generalized or special sort, restlessness or tics. For others it means a neurotic trend, a predisposition to psychopathic manifestations, such as excessive fears, or hypochondriasis, or perhaps only the more obvious behavior anomalies of temper tantrums, feeding problems and similar habitual ways of controlling the environment. For many it is synonomous with emotional instability, a more than average lability of those reflexes which involve the visceral and somatic mechanisms associated with a change in feeling tone. Although it would be futile to determine the relative validity of these definitions it is probably not unreasonable to suppose that the last one represents at least one element in what may be a very complex trait or habit syndrome. Scientifically, at any rate, it has the practical advantage of being capable of direct measurement. By converting the question "Are there individual differences in the ease with which children are upset emotionally?" into "Under the same general conditions do some children give evidence of more shifts of mood as judged by their facial expressions than others?" we may hope for an answer. We may also determine the relation of this frequency of shift of mood to average mood level, to judgments of nervousness and to various established measures of the children. We may attempt too to determine what general environmental factors affect this lability of mood and the mood level in all children and in what ways they affect them. With these aims the present investigation was undertaken at the University of Chicago Coöperative Nursery School in the winter of 1930–31, and financed in part by the Department of Home Economics, a preliminary study of the same nature having been carried out as a class project in the fall of 1929.

The group observed was the youngest at the Nursery School and consisted of 18 children, 9 boys and 9 girls, between two and three years old. Complete health records were available and, except in a few cases where adequate coöperation was not secured, their mental age had been measured by the Kuhlmann scale, the range in the group being 25.8 months to 46.4 months. The observations consisted in three-minute graphic records of shifts of mood, such records being taken at varying hours according to a prearranged schedule so as to con-

stitute as far as possible a random sampling of the child's behavior. In order to avoid a possible tendency to observe the most available or the most conspicuous child, the order was fixed for each observer and was changed each day. In all, 995 records were made and scored as to total number of times a shift occurred from one to another scale division of mood, and also as to the algebraic sum of average feeling tones in each quarter minute. (Figure 1.) Although the observations were made as far as possible when the child was at free play, 44 were made in whole or part in the toilet or cloak room. Five hundred and sixty-six records were made indoors and 429 outdoors, of which 229 were on sunny days and 200 on overcast days. No clear grouping could be made on the basis of temperature or humidity conditions outdoors or in, or of other doubtless important factors depending upon weather conditions.

The observers X, Y and Z were three graduate students in Home Economics all of whom were engaged in some other capacity in the nursery school. There was first a preliminary practice period during which simultaneous observations were made and a seven point scale of mood level objectified as much as possible by discussion of individual cases. At the end of the experiment simultaneous observations were again made to check agreement. The average discrepancy between records taken at the same time was 3.7 per cent for shifts of mood and 7.6 per cent for mood level. X observed from 9:00 to 10:00 a.m. and made 122 observations, Y made 441 observations for the most part between 10:00 and 11:00 a.m. and Z 432 observations between 11:00 and 12:00 a.m. After four weeks X was forced to withdraw from the experiment because of illness and later Y observed from 9:00 to 10:00 a.m. Since there was thus considerable

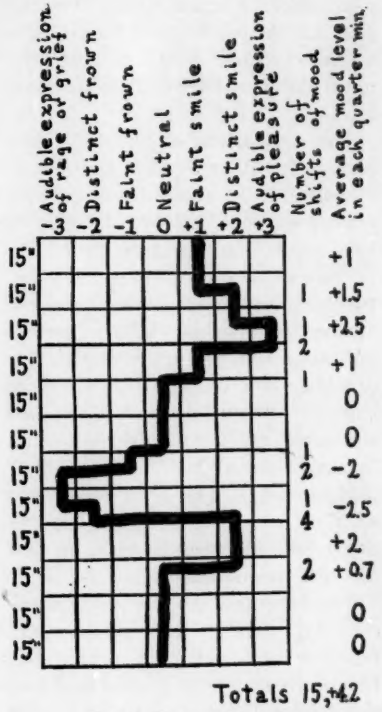

FIG. 1. TYPICAL RECORD

difference in the environmental conditions under which the observers made their records, no high correlation could be expected between them. Between the final rank orders ascribed to the children by X, Y and Z we find an average r of .447 in shifts of mood and .420 in mood level.

The experiment extended over thirteen weeks. Comparing the averages of the individual scores obtained the odd weeks with those obtained the even weeks by the method of Rank Differences $p = .7201$ or $r = .7363$ in shifts of mood, and in mood level $p = .7752$ for which the corresponding r is .7857. Correcting by Brown's Formula the reliability of the test as a whole becomes .8481 ± .0446 for mood shift and .8800 ± .0398 for mood level.

For comparison of the individual scores with other physical and mental measures, only those 13 cases were considered of which over 50 records were made. In this array there is an intercorrelation of .497 ± .147 between the average mood level and the average number of shifts of mood, indicating that the more reactive individuals were on the whole the more cheerful. Frequency of shift of mood correlated with a rating by the teacher in charge as to "nervous instability" .528 ± .141. The only other correlations which were large enough to be significant were between mental age and mood shift and mood level. These were .563 ± .134 and .482 ± .150 respectively. Low positive correlations obtained with weight but practically none with general health or chronological age, the latter finding being perhaps accounted for in part by the small range in our group.

In the preliminary class experiment extending over six weeks and engaged in by eight less trained observers a consistent difference was found between Monday and Tuesday scores. In every case the children showed greater stability of mood on Tuesday. Little more than a tendency in that direction is shown in our present experiment, the most constant change being in the direction of increased instability at the end of the week. No consistent change was found in mood during the week. (Table 1.)

There was a tendency for children to be more stable and happier when at free play than if urged by adults to take off coats, wash hands etc., but this was true for only 8 of the 14 children observed in both situations and our observations in the locker room were few. When indoor and outdoor free play are compared we find all but 4 of the 17 children are more unstable outside, but the effect upon mood level is less general. When the sun shone outside 12 of 15 children were

TABLE 1

Average number of shifts of mood and average mood level for different days of week

DAY OF WEEK	SHIFTS OF MOOD	MOOD LEVEL
Monday	7.44	2.31
Tuesday	6.84	2.39
Wednesday	7.17	2.29
Thursday	6.94	2.83
Friday	9.35	3.12

TABLE 2

Average scores under various conditions

	NUMBER OF MOOD SHIFTS	MOOD LEVEL
Inside, locker room	8.02	1.69
Inside, free play	6.79	2.41
Outside, free play	8.13	2.81
Outside, sunny	8.73	3.03
Outside, cloudy	7.44	2.56
With Mother present	10.15	1.09
General average	7.42	2.55

more unstable and all but 5 were happier. On the days the mother was present all but two of the children were less happy and more unstable. The change in amount and character of the stimulation associated with these environmental factors apparently affects the relatively stable as well as the very reactive child. (Table 2.)

We may conclude (1) that instability of mood and mood level are measurable characteristics of nursery school children, (2) that they are interrelated in the nursery school situation, (3) that they correlate more highly with mental than with physical age or health, and (4) that they tend to be affected in definite ways by environmental factors.

Factors Influencing Friendships Among Preschool Children*

ROBERT C. CHALLMAN

INTRODUCTION

THE fact that friendship is an everyday social phenomenon does not imply that its causation is known or understood. The determiners for the selection of friends have usually been thought to lie in the possession of similar tastes and interests, common likes and dislikes, and to propinquity. The bearing of these particulars upon friendships is to a great extent unknown as yet. It seems quite certain that the approach to the solution of the problem cannot be effected by a simple questioning of mutual friends. It is likely that Almack (1) is correct in saying that the selection of friends is probably not consciously effected, and that "there is grave doubt whether reasons which are given to explain the formation of friendships are real reasons."

It would seem that an observational technique offers a worthwhile approach to the problem, and that the nursery school of an Institute of Child Welfare offers an ideal situation for the use of such a technic. In the first place, in such an institution a number of children are congregated, each child having, theoretically, an equal opportunity to associate with every other child. Secondly, there is an almost ideal environment for the observation of groups because the children are accustomed to the presence of strange adults; the area for play is limited; and the enrollment of the school is fixed. Thirdly, the number of times one child is with another can be used as an objective measure of the strength of the friendships, and other measures of various kinds can be made with relative ease for the purpose of correlation.

PURPOSE

The primary purpose of this study is to discover what factors in addition to propinquity, which is held fairly constant, operate in determining the friendships of young children. It is generally assumed that similarity in traits is conducive to the formation of friendships; therefore this investigation is principally concerned with the extent to which closeness of friendship is influenced by similarity in various particulars. The items selected for scrutiny as having a possible bearing were the following: likeness in sex, chronological age, mental age, intelli-

* From the Institute of Child Welfare, The University of Minnesota. The writer wishes to thank Florence L. Goodenough, who suggested this study and acted as statistical adviser, John E. Anderson, Josephine C. Foster, and Charles Bird.

gence quotient, height, attractiveness of personality, and degrees of extroversion, sociality, physical activity, laughter, and social participation.

SURVEY OF THE LITERATURE

Few studies have been made in this field of social relations, and some of these have not been entirely satisfactory in technique. Two studies have dealt with adolescent friendships. One was by Warner (7) who found that 66 delinquent boys, presumably adolescents, grouped in gangs and in pairs tended to be slightly more alike in M.A. than in C.A. Williams (9) in a questionnaire study of 84 adolescent boys in a school for delinquents, who ranged in age from 12 to 17 years, and in mental age from 9 to 15.5 years, found a tendency for friends to be of about the same C.A. and M.A. Neither of these studies is adequately treated statistically.

Three studies of older school children have been made. Wellman (8) using an observational method by which she selected as friends the pairs of children seen most frequently together, studied 29 pairs of boys and 27 pairs of girls in the 7th, 8th, and 9th grades. Her study indicates that pairs of girls are more alike in scholarship, physical achievement, and extroversion and less alike in height, and C.A. Boys, on the other hand, are more similar in height, C.A., and I.Q. and less alike in extroversion, scholarship, and M.A.

From 387 school children in grades four to seven Almack (1) obtained the names of the boy or girl each child would choose to help him if he were given some work to do for which the person was well fitted. Each child was also asked to name the boy or girl he would first invite to a party. The correlation coefficients between the C.A.'s of the children and the C.A.'s of those with whom they chose to work was .53; between M.A.'s .54; and between I.Q.'s .41. The coefficient between the C.A.'s of the children and those of the invited boys was .50; between M.A.'s .54; and between I.Q.'s .32. The corresponding coefficients for the invited girls were C.A. .42, M.A. .50, and I.Q. .30. He concludes that there is a tendency for children of these ages to select associates from their own mental level.

Sixty-two pairs of pre-adolescent chums comprising 35 different individuals having a mean C.A. of 9.5 years (S.D. 17.9 months), were studied by Furfey (4). The obtained correlation coefficients between chums are as follows: C.A. .39, Developmental Age .37, height .34, M.A. .24, and weight .22. The probable errors are $-.07$ for the first two and $-.08$ for the rest. His conclusion is that there is a tendency for boys to choose chums of the same size, age, intelligence, and maturity as themselves.

A quite comprehensive study of spontaneous groups of preschool children somewhat similar to this one was made by Chevaleva-Janovskaja (3) in Odessa. She investigated 888 groups composed of 276 children. It was discovered that more boys participated in groups than girls, i.e. of 100 boys, 68 participated in groups, but of 100 girls only 56 did so. It was also found that the mean for participation in groups increased with age from 7.16 at 3 years to 11.9 at 4, and 12.25

at 5 years. In 67 per cent of the groups, the children were of the same age or differed by a year, and in only a little over one per cent was the difference as much as four years. She states that the tendency to join with a child of little different age is more marked in boys than it is in girls, and that children of three to five years of age form bi-sexual groups more often than unisexual. When unisexual groups were formed they were usually masculine. She also found that some kinds of play material favored the formation of groups of equal age particularly in the higher age groups.

SUBJECTS

Thirty-three children, 17 boys and 16 girls, in the nursery school of the Institute of Child Welfare at the University of Minnesota were used as subjects. The means and S.D.'s of the chronological ages and mental ages in months, the intelligence quotients, the height in centimeters, the attractiveness of personality to adults in total scores as obtained by a rating scale, the degree of extroversion in terms of the combined ratings of 12 judges using the Marston Scale, the degrees of sociality, physical activity, and laughter expressed in sigma scores, the degree of social participation, the occupational class, and the friendship indices for the boys and for the girls are given in table 1. The means and ranges for the same items are also given for the combined sex groups.

It can be seen by an examination of this table that in intelligence quotient and height, these children are slightly better than the average. They are also superior to the average in socio-economic status and are more extroverted than the group Marston used. In comparing the means of the boys and girls, we find that the groups are practically equal in respect to age, mental age, intelligence quotient, height, sociality, laughter, attractiveness of personality, and occupational class. The boys are more active physically. The girls are more active

TABLE 1

Means and S.D.s of boys and of girls, means and ranges of combined sexes on various items

	GIRLS		BOYS		BOTH	
	Mean	S.D.	Mean	S.D.	Mean	Range
C.A.	43.2	7.7	44.5	8.3	43.8	27.1– 59.4
M.A.	48.9	10.6	48.7	13.8	48.8	30.0– 74.0
I.Q.	112.7	10.3	108.5	16.3	110.5	77.0– 160.0
Height	100.5	6.2	100.3	5.0	100.4	89.5– 110.6
Personality	32.1	8.3	30.7	10.3	31.4	14.0– 50.0
Extroversion	779.0	116.0	812.0	161.0	796.0	491.0–1047.0
Sociality	3.02	.33	2.98	.34	3.00	2.24– 3.41
Phys. Activ.	2.88	.19	3.11	.26	3.00	2.41– 3.39
Laughter	3.02	.16	3.00	.25	3.00	2.74– 3.50
Soc. Partic.	5.85	1.1	4.92	1.2	5.39	3.25– 8.66
Occ. Class	2.82	1.4	2.88	1.4	2.85	1.0 – 5.0
Friendship Indices	.32	.14	.23	.17	.15	.02– 1.9

socially and have a higher mean friendship index. The latter may be owing to the fact that boys are more often alone and that they form smaller groups. No significant differences between the sexes in variability were discovered although the differences found were mostly in the direction of greater variability among the boys. The differences in variation in M.A. and I.Q. appear rather large, but they were in the main due to two extreme cases in the boys' group.

METHOD

The general method was the observation and notation of the names of the children who were found in the same group at the free play hours. During these periods the initiation and control of activities by the teachers are at a minimum. A group was considered to exist when two or more children were in close spatial relationship more or less isolated from other children or when they were mutually engaged in the same activity. When fifty per cent or more of the membership of a group was changed, it was called a new group. Those groups whose membership had been influenced by teachers were omitted.

Two slightly different methods of notation were used. The writer's method was to enter a room and note down the names of the children who were together in groups. Any child who was in a group for fifteen seconds was considered a member. In practice, this minimum was seldom used, as practically all the children who were counted were together for at least one minute. When all groups were noted, he went to the other rooms and followed the same procedure until all the groups had been recorded. Then he re-entered the first room and started over again. It usually took about five minutes to make the rounds and in any case identical groups were not recorded until five minutes had elapsed from the time they had been last recorded. Nine other observers, in connection with various observational studies (5), also noted down the names of the children in the same group with the child they were observing. The observations were made between October fifteenth and November eighteenth, 1928. Over 200 hours were spent in observation, and 7,248 groups were recorded.

Although the observational method is believed to have the most advantages in approaching this aspect of social relations, there are some sources of error which should be mentioned. That children were counted as in the same group even though they were paying little attention to each other at the time results in a small error, but as this kind of group constituted only a small percentage of the total groups it is possible that more error would have been introduced by interpreting the quality of the group than by counting all in more or less isolated groups as members. It is also impossible to know to what extent chance operated in the formation of groups. The mere fact that a child enters a certain room upon arriving at the nursery school might influence at least the first few groups he becomes associated with. Besides this, certain other groups that were largely chance groups were included in the tabulations. These, the mid-afternoon

lunch group, the structure of which depends largely upon the time of waking from the nap, and the groups that were being dressed for going to the playground were found to comprise 7 per cent of the total number of groups.

Another source of error is that two methods of observation were used, one by the writer, and another by the nine observers. This may have lowered the reliability of the method to some extent. In 23 or 70 per cent of the cases, however, each child's strongest friend, as found by the writer, was the same as that found by the other observers. In 8 or 24 per cent of the cases the child who was found to be the strongest friend by the writer was found to be the next strongest by the other observers. In two cases there was a discrepancy of three and four places respectively, but in these cases no definite preference was shown for any child. The same held to a lesser extent in the 8 cases cited above. It is the writer's belief that a truer measure was obtained by the use of records from the nine additional observers in consideration of the fact that the number of groups is increased so greatly.

Perhaps the most important source of error lies in the fact that, when children are engaged in the same activity, it is impossible to know to what extent they are attracted by the specific play material and to what extent they are attracted by the children in the group. With the present technic, the exact weight of each factor cannot be ascertained. It is probable that both factors are operating. That the associates are more important can be inferred from the fact that the same group from time to time will engage in a variety of activities.

TREATMENT OF DATA

After the observations had been completed, a tabulation was made of the number of times each child was found in the same group with every other child by each observer. These were summed; thus the total represented for each child the number of times he was found with every other child. In order to equate absences, each of these totals was divided by the number of hours of observation made at times both children were in attendance at the nursery school. For example, Child A was found with Child B 150 times. They were both present on 30 specific days, and 100 hours of observation were made on those days. Thus the number of times per hour the two children were together is 1.5. This number (1.5) and others similarly derived for every possible pair of children serve as a quantitative measure of the strength of friendships. Hereinafter they will be referred to as friendship indices. The total number of indices was 528.

These friendship indices were distributed with pronounced positive skewness as is shown in figure 1. This non-normality of distribution is to be expected in dealing with such data since each child is apt to make a relatively weak association with almost every other child in the nursery school and to have only one or two strong friendships. The points representing the strong friendships can be seen strung out along the abcissa. Another

factor operating to produce the skewness is the inclusion of chance groups amounting to 7 per cent of the total number. These were not excluded because at the time of the tabulation the present treatment of the data was not contemplated. The inclusion of these chance groups would increase the number of relatively weak friendships more proportionately than it would the strong ones, as can readily be seen. the lower scores. It does not bring into play any spurious relationships, nor does it tend to raise the correlation.

The differences between the scores of each child and every other child was next obtained for the various items. The records of chronological age, mental age, intelligence quotient, and height were taken from the files of the Institute of Child Welfare. The score for social participation was obtained

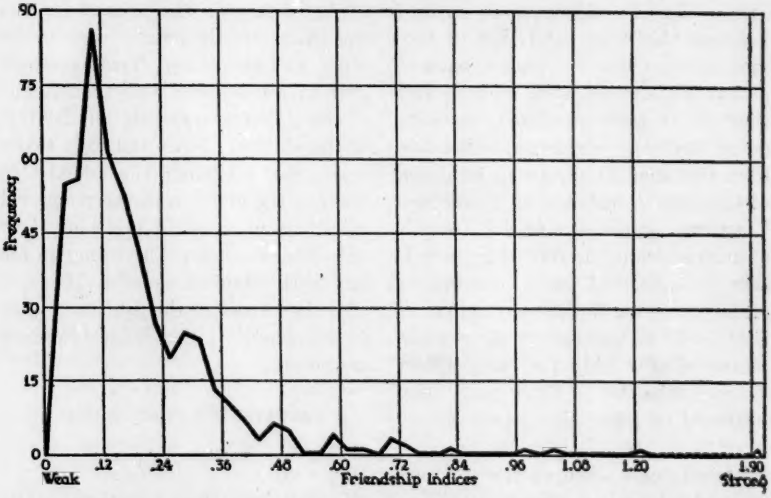

FIG. 1. FREQUENCY POLYGON SHOWING ORIGINAL DISTRIBUTION OF FRIENDSHIP INDICES

As the found distribution could not be grouped into class intervals because of its extreme range, it was thrown into a normal one by adjusting class intervals to fit it, thus making the data subject to correlational treatment (6). This transformation scheme is empirical but it should be noted that it tends mainly to draw in the upper extreme and to displace somewhat toward the middle the distribution of

by dividing the total number of children the child was associated with by the number of hours he was present and observed. The method of obtaining the scores for attractiveness of personality, extroversion, sociality, physical activity, and laughter is explained in the article by Goodenough cited above. The reliabilities for the first two (ratings) are high, being .95 and .98 respectively, but the reliabili-

ties of the observational studies are not so high, being .76, .86, and .83 respectively.

When the aforementioned differences between every possible pair of children on these ten items were found, they were correlated with the friendship indices. Thus, for example, the differences in age (found by subtracting each child's age from that of every other child) was one variable and the friendship index the other. Herein lies the difference in method between this study and that of previous ones. In other studies, pairs of strong friends only were selected and their traits were correlated, the idea being that any significant difference from zero would indicate an influence of the trait in question on friendship. There was no measure of the strength of the friendship. In this study, friendship is conceived as a continuous variable existing in different amounts. Each child is believed to have some degree of friendship for every other child; antipathies, if present, are expressed by friendship indices of low magnitude. In this way, the correlation coefficients when all the children are used is based on 528 relationships, not 33 cases.

It became evident soon after the computation of the data was begun that the sex of the children had a very strong influence on the strength of their friendships; so the children were divided into four groups: (1) boys with boys, (2) girls with girls, (3) boys with girls, and (4) all children, in which every child was included. Pearsonian product-moment correlations were then calculated within each group. Pearsonian r's were also calculated between age (not closeness in age) for the groups mentioned above, and biserial r's were calculated between strength of friendship and like and unlike sex for the lower and upper age groups and for all the children. To supplement these correlations, the pairs showing the strongest reciprocal friendships, four pairs of girls and three pairs of boys, were selected. The average of the differences petween these children in the various items (C.A., M.A. etc.) the pairs of boys in one group and the pairs of girls in the other, was computed. These averages were then compared with the average of the differences among all the rest of the children, boys and girls taken separately, including the friendships between the children in the reciprocal friend group with all other children except each other. The formulae for finding the significance of a difference were then applied, the difference over the standard deviation of the difference being used.

RESULTS AND CONCLUSIONS

Influence of C. A.

Table 2 shows the correlations within the different groups between increasing age and strength of friendships. These coefficients show that boys have a slight tendency to associate with other boys as age increases, and also that they tend to associate with special ones. It would seem that the same tendency is shown in the coefficient for boys with girls, but the scattergram shows that two boys over 56 months were responsible for most of the correlation. When these are omitted, the correlation drops to .10.

Girls show no particular tendency to associate more with other girls, or boys, nor with certain ones as age increases. At first glance, these results seem somewhat different from those obtained by Chevaleva-Janovskaja, as she found that the means for participation in groups increased with age. There is only an apparent discrepancy, however, as the correlation between social participation and age is .30 which is in accord with her findings. The fact that these correlations are low has a certain value in that it shows that the correlations found with similarities in other traits are not merely a function of increasing age. The only correlations that can be questioned are those in the boys-boys group. A correlation of .24, however, particularly when it is of the second order, would not in the writer's belief have a very decided effect on the coefficients.

TABLE 2

Effect of increasing age on strength of friendships

(r C.A. with F.I.)

INDIVIDUALS CORRELATED	r	P.E.
Boys with boys	+.24	±.04
Girls with girls	+.03	±.04
Boys with girls	+.30	±.04
Boys with girls (56–58 mos. omitted)	+.10	±.04
Girls with boys	+.07	±.04

Influence of Sex

The most unexpected result in this study is that even the youngest children discriminate very decidedly in their friendships on the basis of sex. Only one boy, a child of thirty months, was more often with girls than with boys, and only one girl twenty-six months old showed even a marked tendency to form friendships with children of the opposite sex. The biserial r for the youngest age group (27 to 45 months) is .53, for the highest age group (46 to 59 months) .56, and for all the children .55. The result for the youngest group are presented in figure 2. Here it is shown that in only eight per cent of the cases are friendships between unlike sexes stronger than the median strength of those between like sexes, while eighty-two per cent of the like-sex friendships exceed the median of those of the unlike sex. In the upper age group the corresponding figures are 5 and 84, and the results are very similar when one curve is drawn for all the children. This finding seems opposed to the statement of Chevaleva-Janovskaja (3) that children from three to five years of age form more bisexual than unisexual groups. As no quantitative expression is given to back up this assertion, it is hard to determine its validity. It is possible, however, for both her statement and the writer's finding to be true because many of the bisexual groups may have consisted of a large majority of one sex with one or two children of the other. If this is true, then it could happen that each sex keeps mainly to itself and yet more bisexual than unisexual groups are formed.

Influence of similarities on strength of friendships

Before discussing the significance of the correlation coefficients given below, consideration of the conditions affect-

ing their magnitude should be given. The following items tend to lower the obtained coefficients: (1) the inclusion of 7 per cent known chance groups; (2) the inclusion of unknown chance groups, probably of no great moment; (3) physical proximity taken as one of the criteria for the existence of a group; (4) the none too high reliabilities of the studies of sociality and physical activity; and (5) the influence of play material in the formation of groups. Thus it is reasonable to suppose that the correlations found are minimal, and that in all probability they should be higher.

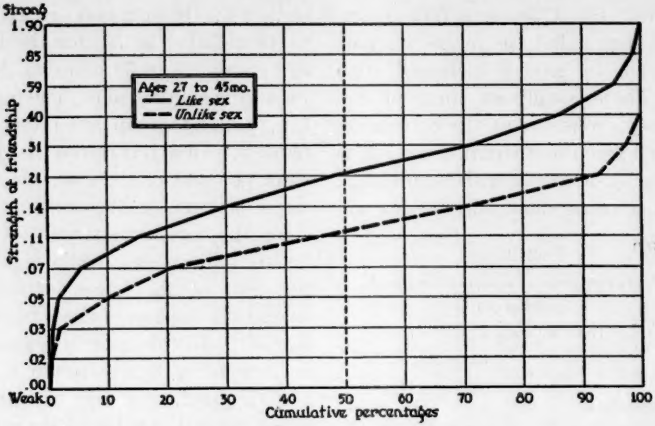

FIG. 2. OGIVE SHOWING STRENGTH OF FRIENDSHIP BETWEEN LIKE SEXES AND UNLIKE SEXES EXPRESSED IN MAGNITUDE OF FRIENDSHIP INDICES

TABLE 3

The correlation coefficients between similarity in various items and closeness of friendship for boys with boys, girls with girls, boys with girls, and all children

	B–B	G–G	B–G	ALL
N	136	120	272	528
C.A.	+.562 ± .039	+.348 ± .053	+.295 ± .037	+.297 ± .026
Soc.	+.504 ± .043	+.346 ± .053	+.150 ± .039	+.252 ± .027
Phys.	+.355 ± .050	+.227 ± .058	−.082 ± .040	+.226 ± .028
Soc. P.	−.109 ± .057	+.430 ± .050	+.055 ± .041	+.114 ± .028
M.A.	+.264 ± .054	+.158 ± .060	+.182 ± .039	+.183 ± .028
Ht.	+.228 ± .054	+.199 ± .059	+.065 ± .044	+.085 ± .029
Ext.	+.016 ± .058	+.284 ± .057	+.157 ± .031	+.130 ± .029
Pers.	−.038 ± .057	+.201 ± .059	+.107 ± .041	+.058 ± .029
I.Q.	−.001 ± .058	+.161 ± .059	−.045 ± .040	+.046 ± .029
Laugh	−.069 ± .058	+.051 ± .061	−.125 ± .040	−.049 ± .029

Table 3 shows the coefficients obtained in the different groups when

similarities in the items were correlated with closeness of friendship. In table 4 are presented the critical ratios between the mean differences of reciprocal friends on the selected items and the mean differences of the rest of the children. These two tables will be discussed together as they supplement each other.

General trends of the data

Considering the tables as wholes, the following trends may be seen. The correlation coefficients in the first column (Boys-Boys) are both higher and lower than those in the second (Girls-Girls). That is, there are two coefficients of .5, one of .3, two of .2, one of .1 and four approximating .0; in the second column, however, there are one of .4, two of .3, three of .2, three of .1, and one approximating .0. One might infer from these data that certain traits are quite important in the formation of boys' like-sexed friendships and that other traits have negligible significance. With girls' friendships on the other hand fewer traits are of primary importance and more traits have some significance. Secondly, the coefficients in the third column (Boys-Girls) are almost uniformly low, that with C. A. being the only one of possible significance. This points to the conclusion that similarities or differences between children of unlike sex, at least in the items studied, have little to do with formation of friendships between them. This conclusion, if justified, also explains the lowness of the correlation coefficients in the fourth column in which sex is disregarded. Because these coefficients are masked, by the sex factor, they will not be considered further in this paper. Thirdly, it should be noted that the critical ratios in table 4 with one exception bear out the trends of the results when the boys' group is compared with that of the girls'.

TABLE 4

The critical ratios between the mean differences of reciprocal friends on various items and the mean differences of the rest of the children

	B–B	G–G
N	6	8
C.A.	8.38	.72
Soc.	7.08	10.55
Phys.	4.80	*.85
Soc. P.	.17	2.43
M.A.	1.95	.16
Ht.	2.71	1.53
Ext.	*.46	*.85
Att of Pers.	.80	4.02
I.Q.	.02	.48
Laugh	.05	2.89

* The starred figures represent differences of means in the opposite direction.

Closeness of chronological age and closeness of friendship

That boys show a distinct tendency to make friends with boys of like age, and that girls show the same tendency

to a lesser degree is evident in the coefficients of .562 and .348 in table 3. Also, in table 4, a very significant difference between the average of the differences between reciprocal boy friends and that among the rest of the children is found, while with girls, the difference is not significant. This non-significance is to some extent owing to the fact that one of the friendships was between girls who lived next door to each other and who differed in age by over a year. Similarity in age was found to be an important factor by Wellman in her work on junior high school students and by Chevaleva-Janovskaja on preschool children. Both investigators found that it was of more fundamental importance in boys' friendships than in girls'. The reason for this sex difference is not so easily found. Facts which may have some bearing are that girls play "family" much more than boys, a game that necessitates a much younger child for the baby; older boys engage in vigorous activities in which the younger boys cannot participate. The writer does not believe, however, that these two facts offer a complete explanation, particularly in view of the findings with older children.

Closeness in sociality and closenesss of friendship

As the correlation coefficients indicate, there is a definite tendency for both boys and girls to form friendships with like-sexed children similar to themselves in sociality. There is a discrepancy between the two tables, however, in the direction of the importance of the trait. Table 3 indicates that the trait is more important in the friendships between boys, and table 4 that it is of greater import in the friendships of girls. In view of the number of cases involved in the two tables, it is probable that the correlation coefficient is the more correct, and that some chance influence is operating in the friendship of the four pairs of girls.

Certain facts about the play interests of children have a bearing on this finding. "Sociality" is more or less a measure of the degree of organized coöperative activity. Thus those children who like coöperative activities are apt to play together and to become friends. Boys on the one hand, as Bridges (2) has shown, prefer activities like building with bricks, cube construction and the like, activities that can be carried out with others who like the same kind of occupation, while girls tend to prefer threading beads, color matching, and the like, activities not so readily performed in coöperation. These facts help to explain the higher correlation between sociality and friendship among boys and the lower one among girls. Of course, the relationship may work the other way, that is, a preference for organized activities might tend to bring together certain boys because they prefer the activity and not the children engaged in it.

Closeness in physical activity and closeness of friendship

Likeness in physical activity does not exert so great an influence on strength of friendships as does age or sociality, but it does affect the friendships of boys with each other in some degree and in those of girls it is just

perceptible. With reciprocal friends the same result can be seen, it being all the more evident that similarity in physical activity is less important with girls.

These results are more or less what one would expect. Bridges (2) found that three-year-old boys prefer activities requiring large movements and involving a marked output of physical energy, whereas girls prefer activities involving finer movements and requiring little exertion. It would be natural, then for boys to prefer as their companions other boys similar to themselves in physical activity who would play games at a similar level. With girls, this would not be so true.

Closeness in social participation and closeness of friendship

As will be remembered, the score for social participation was obtained by dividing the number of children each child was with by the number of hours he was in school and observed. Thus the participation score is the average number of children per hour each child was associated with. The correlation coefficients as well as the critical ratios show that boys who mix with about the same number of children have no tendency to become friends. In other words, the solitary boy does not tend to become friends with other solitary boys nor do gregarious boys make friends with others of the same stamp. With girls, on the other hand, the tendency is reversed. They tend to form friendships with other girls of about the same degree of social participation.

Closeness in mental age, height, and closeness of friendship

If age were held constant, the coefficients between these two items and strength of friendship would probably drop to approximately zero, as the correlation between closeness in I.Q. and closeness of friendship indicates. The critical ratios are not significant either, which confirms the supposition. It is likely, then, that mental age and height have no influence on friendships.

Closeness in extroversion, attractiveness of personality, I.Q., and frequency of laughter and closeness of friendship

All these coefficients are too small be significant, and table 4 shows that reciprocal friends have very little tendency to be alike in these characteristics. These results might be expected from an a priori standpoint, at least in respect to laughter and I.Q. One might expect, however, that children similar in attractiveness of personality would be friends, and this tendency may be present to some extent in the friendships of girls (r = .201 $\pm$.059, critical ratio 4.02), but its influence if present is very slight. The fact that attractiveness was rated by adults and the probability that a child with an attractive personality might attract other less attractive children also cast doubt on its influence on preschool friendships.

SUMMARY

A study was made of the factors in addition to propinquity that influence the formation of friendships among

preschool children. Thirty-three nursery school children, 17 boys and 16 girls, ranging in age from 27 to 59 months were used as subjects. The method was the observation of groups, the number of times each child was with every other child being used as the criterion for strength of friendship. The items selected for study were likeness in sex and similarities in C.A., M.A., I.Q., height, attractiveness of personality, and degrees of extroversion, sociality, physical activity, laughter, and social participation.

The following results were obtained. (1) Boys have a slight tendency to form stronger friendships with other boys as they grow older. (r = .24 ±.04). This tendency is not present in the boys' friendships with girls nor in girls' friendships with each other. (2) There is a marked cleavage in friendships on the basis of sex, children of each sex tending to form friendships within their own sex. (3) None of the items investigated with the possible exception of C.A. has any influence on friendships between boys and girls. (4) Similarities in C.A., sociality, and physical activity have an influence in the order given on the friendships of boys with boys. (5) Similarities in social participation, C.A., and sociality and possibly physical activity influence the formation of friendships between girls in the order given. The correlation coefficients are lower in the case of C. A., sociality, and physical activity than are the corresponding ones of the boys, a fact which indicates a lesser influence. (6) Similarity in mental age, height, extroversion, attractiveness of personality, I.Q., and frequency of laughter have no influence on either boys' or girls' friendships.

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A Study of Sleep Habits of Two Groups of Preschool Children, One in Hawaii and One on the Mainland

ALIDA VISSCHER SHINN

PROBLEM AND METHOD

IN THIS study the following major problems, dealing with the sleep of children from 1 year to 6 years of age, have been considered:

1. How long does it take children to go to sleep at nap?
2. How long do children sleep during the nap?
3. How long does it take children to go to sleep at night?
4. How long do children sleep at night?
5. How long is the total sleep?
6. How does the median total sleep of Vassar College Nursery School compare with Castle Kindergarten?
7. How does weight correlate with total sleep?
8. How does nap correlate with night sleep?
9. How does mental age correlate with total sleep?
10. Is there any special rhythm to total sleep?
11. How does the humidity affect length of total sleep?
12. How does the temperature affect length of total sleep?

Sources of data

There were two groups observed to obtain material for this study: one at Vassar College, Poughkeepsie, New York, and the other at the Castle Kindergarten, Honolulu, T. H.

The Vassar group consisted of 30 children ranging in age from 1 year 10 months to 4 years 9 months, who, with their mothers, were attending the Euthenics Institute from June 26 to July 26, 1928. The parents of the children were mostly college graduates and were of Anglo-Saxon parentage. While the mothers attended college classes on child psychology and home making, the children attended the nursery school. The children returned to the dormitory with their mothers at night and for an hour during the afternoon. In the morning the children had a rest of 45 minutes and in the afternoon they took naps. The majority of the children had rooms alone at night, but occasionally two children were in a room or the child may have slept in his mother's room. Each child slept alone.

After the mother put the child to bed, she recorded the time on a typed record sheet of paper that was hanging in her corridor. A teacher was in charge of each corridor to record the time each child went to sleep. The mother wrote the time of awakening the next morning. Occasionally, a

mother would forget to sign up, thus making a gap in the record necessitating elimination of that day's record from the study. Otherwise, the records are full and accurate.

At the nursery school there were 2 sleeping rooms, one with 8 children and the other with 22. The children slept on canvas beds in rooms which were not especially darkened. Two teachers were in each room to supervise the sleep. The median mean temperature for the period was 73.5° ranging from 66° to 82.5°, and the median average relative humidity was 75, ranging from 56 to 94. The temperature readings were those obtained from the Wappinger Falls Weather Bureau for Poughkeepsie. As this station had no hygrometer, the nearest humidity obtainable was from New York City which is 72 miles from Poughkeepsie. The average relative humidity was obtained from recordings at 8:00 a.m. and at 8:00 p.m. each day.

The Merrill Palmer Performance Tests for Children of Pre-School Age were given to each child by a psychologist. The heights and weights were obtained at approximately the middle of the experiment. The chronological ages used in the records were those obtained at the same time.

The Castle Nursery School and Kindergarten group of Honolulu, consisted of 136 children ranging in ages from 1 year 5 months to 5 years 10 months. The records in the nursery school began September 23 and ended October 25, 1929. The kindergarten records began October 8 and ended November 11, 1929. The nursery school naps were recorded at school. The nursery school night sleep and the kindergarten nap and night sleep were recorded by the parents at their homes. The hours recorded daily varied greatly showing that a great effort for accuracy had been made. Approximately 180 questionnaires a week were sent out; 136 satisfactory questionnaires were returned, many of them complete records for the whole period. These questionnaires are the basis of this section of the study. Before the questionnaires were sent they were explained fully to the parents in a group meeting. Directions were given in English, Chinese, and Japanese. The coöperation obtained from the mothers was more than had been anticipated. They said they were glad to help as they were "anxious to know how long their children should sleep." The mothers who kept these records so faithfully were of varying economic status. The racial group predominating, however, was Oriental. The Oriental cases numbered 96 as opposed to 22 Anglo Saxons, 10 Hawaiian, 5 Portuguese, and 3 Filipino.

The mothers were asked to record the time the child was put to bed, the time the child went to sleep, and the hour at which he awakened both for nap and night sleep. Even if the child did not go to sleep at nap time, record was to be made of this fact. The sleeping conditions of the children varied greatly and for the most part showed great contrast to those of the Vassar group. A majority of the Honolulu group slept in rooms with one or more people. Most of them slept on beds but a few Japanese slept on matting on the floor. The kindergarten children had a 20 minute rest period in the morning and the nursery

school children a rest of 45 minutes. The nursery school children did not go to sleep in the morning but slept in the afternoon. The room was not darkened. The children lay on the floor on mats covered with a sheet and, if needed, a blanket. The median mean temperature for Honolulu during the experiment was 78°, ranging from 74° to 80°, and the median average relative humidity was 72, ranging from 66 to 89.

The height was taken at the beginning of the time, for the nursery school during the week of September 23, and for the kindergarten during the week of October 8. The weight of the nursery school children was taken during the first week (September 23–27) and during the last week (October 21–25) and the average weight for the period calculated. The weight for the kindergarten was taken at the beginning, during the week of October 7–11 and during the last week, November 5–11, and the average weight calculated.

The Goodenough Drawing Test of Intelligence was given to the children over 4 years of age. The test was not given under this age as there is no correlation with the Terman Revision of the Binet below that age. The average correlation between the Binet and the Goodenough for the age 4 years to 10 years is .741 with a P.E. of ±.016. Such a test was considered desirable, as many of the children hear only Oriental languages in the home. By using a performance test such as the Goodenough, the language element was largely eliminated. The tendency to respond negatively to language tests by young children, especially bilinguals, was overcome. The test was given during the last week, November 5–11.

The age of each individual child was calculated from the middle of the period, after which the child was placed in a group from 1 year 0 months to 5 years 12 months in groupings of 6 month intervals.

There were no special methods used to induce sleep except restraint of excess motion when absolutely necessary. The standard set for parents and teachers for recognizing the onset of sleep was the cessation of movement and the continued closure of the eyes

In order to ascertain the influence of relative humidity on total sleep, it was necessary to use the Honolulu group in order to eliminate the influence of varying temperature. This elimination could be done as the temperature was fairly constant, ranging from 74° to 80°. The recordings of relative humidity were divided into low, medium and high groups; the humidity in the low group ranging from 66 to 67.5; in the medium group, from 71 to 80.5; in the high group, from 87.5 to 89. The records of 3 days' relative humidity were placed in each group. The median total sleep for those days was found and compared with the groups of varying relative humidity. After having ascertained the influence of relative humidity, the influence of temperature on the Vassar group was then determined by selecting as samples the records for 3 days each of low, medium and high temperatures. The average for the days of lowest temperature was 69°, for medium 72.3°, and for the highest 78°. The median total sleep for these days was found and compared with the groups having varying

TABLE 1

*Comparison of sleep records of Castle and Vassar nursery schools**

AGE GROUP	NURSERY SCHOOL	NUMBER OF CASES	NAP		NIGHT		TOTAL TIME SLEPT
			Minutes to go to sleep	Time slept	Minutes to go to sleep	Time slept	
yrs. mos. yrs. mos.				*min.*		*hrs. min.*	*hrs. min.*
1 0 - 1 6	Castle	2	15	70	5	11 30	12 40
	Vassar						
	Differences						
1 7 - 1 12	Castle	4	25	60	15	11 00	11 50
	Vassar	3	25	90	25	10 55	12 30
	Differences		0	−30	−10	5	−40
2 0 - 2 6	Castle	8	20	75	15	11 00	12 10
	Vassar	6	20	90	30	10 40	11 55
	Differences		0	−15	−15	20	15
2 7 - 2 12	Castle	6	20	75	25	10 10	11 25
	Vassar	4	40	80	75	10 10	11 35
	Differences		−20	−5	−50	0	−10
3 0 - 3 6	Castle	14	45	55	15	11 00	11 30
	Vassar	6	45	80	55	10 10	11 20
	Differences		0	−25	−40	50	10
3 7 - 3 12	Castle	12	30	45	15	10 55	11 35
	Vassar	4	40	65	70	10 00	10 55
	Differences		−10	−20	−55	55	40
4 0 - 4 6	Castle	14	30	50	15	10 45	11 25
	Vassar	5	45	45	35	10 45	11 05
	Differences		−15	5	−20	0	20
4 7 - 4 12	Castle	25	35	45	20	10 45	11 30
	Vassar	2	30	60	65	9 45	10 45
	Differences		5	−15	−45	60	45
5 0 - 5 6	Castle	37	35	40	15	10 50	11 20
	Vassar						
	Differences						
5 7 - 5 12	Castle	14	X	00	15	10 45	11 25
	Vassar						
	Differences						

* The differences were obtained by subtracting Vassar records from Castle records. The minus sign indicates longer time for Vassar group.

temperatures. The experiments in both situations were conducted by the same person, thus insuring uniformity of procedure.

RESULTS

Time required to go to sleep for nap

The time to go to sleep for nap at Castle ranges from 15 minutes to 45 minutes, and at Vassar from 25 minutes to 45 minutes. There is no apparent tendency to increase or decrease with age during the preschool period. There are 4 positive records opposed to 3 negative records. This shows that the median time to go to sleep in the two places is about the same. (Table 1).

Another tendency with regard to nap is seen in table 2, which is a record of the days the children took rests but did not sleep. The Castle group shows a tendency for the number of naps to decrease as the child gets older. The tendency is for the child of 1 year to sleep every day, the number of naps decreasing fairly regularly until minutes longer from 4 year 0 months to 4 years 6 months. In other words, the 6 negative records indicate a longer nap for Vassar than for Castle.

TABLE 2

*Per cent of days with rest, without sleep Castle kindergarten and nursery school**

AGE GROUP	NUMBER OF CASES	NUMBER OF DAY RECORDINGS (REST AND SLEEP)	NUMBER OF DAY RESTS (WITHOUT SLEEP)	PER CENT OF DAYS WITHOUT SLEEP
yrs. mos. yrs. mos.				
1 0 – 1 6	2	30	00	00
1 7 – 1 12	4	57	12	21
2 0 – 2 6	8	142	6	4
2 7 – 2 12	6	90	4	4
3 0 – 3 6	14	212	88	42
3 7 – 3 12	12	224	93	42
4 0 – 4 6	14	396	162	41
4 7 – 4 12	25	594	254	43
5 0 – 5 6	37	791	368	47
5 7 – 5 12	14	236	136	58

* The number of recordings are the sum of the individual records for each age group, including those with and without sleep. The per cent of days without sleep for each age group was obtained by dividing the days without sleep by the number of recordings for that group.

Length of nap

The length of nap at Castle shows a tendency to reduce irregularly from 75 minutes to 40 minutes and the nap entirely disappears at 5½ years according to the median records. At Vassar the nap ranges from 90 to 45 minutes. With one exception only, the Vassar children had longer naps than the Castle children. The one exception was when the Castle children slept 5 at 5 years 7 months he sleeps 42 per cent of the nap periods.

Time required to go to sleep at night

The time required to go to sleep at night by the Vassar group was longer in each case. The Vassar range is from 25 minutes to 75 minutes and the Castle range is from 5 to 25 minutes. The longer nap at Vassar may have been the cause of the longer time required to go to sleep at night.

The length of night sleep

The length of night sleep at Castle tends to decrease fairly regularly from 11 hours and 30 minutes for the group from 1 year 0 months to 1 year 6 months to 10 hours and 45 minutes for the group 5 years 7 months to 5 years 12 months. The range is from 11 hours and 30 minutes to 10 hours and 10 minutes. The 10 hours and 10 minutes may be caused by the small number of cases in the group. In the Vassar group the decrease is even more regular, the total declining with only one exception. The range is from 10 hours and 55 minutes for the 1 year 7 months to 1 year 12 months group, to 9 hours and 45 minutes for the 4 year 7 months to 4 years 12 months group. The Hawaii group tends to sleep longer at night than the Vassar group.

Median total sleep and comparison of Vassar and Castle

The median total sleep for Castle tends to decrease irregularly from 12 hours and 40 minutes to 11 hours and 20 minutes. The children of the 1 year 0 months to 1 year 6 months group tend to sleep the most. The children from 5 years 0 months slept 11 hours and 20 minutes. At Vassar the range was from 12 hours 30 minutes, for the 1 year 6 months to 1 year 12 months group, to 10 hours and 45 minutes for the 4 year 7 months to 4 years 12 months group. There are only 2 age groups in which the Vassar children had more total sleep than the Castle children; at 1 year 7 months to 1 year 12 months, they had 40 minutes more; and from 2 years 7 months to 2 years 12 months, 10 minutes more. The Castle children slept 15 minutes more between 2 years 0 months and 2 years 6 months; 40 minutes more between 3 years 7 months and 3 years 12 months; 20 minutes more between 4 years 0 months and 4 years 6 months; and 45 minutes between 4 years 7 months and 4 years 12 months.

Correlation between weight and total sleep

The correlation between weight and total sleep is .002 $\pm$.06 which is practically a 0 correlation. By partialling out height and age, the partial correlation is $-$.11 $\pm$.06 which shows no significant correlation present.

Correlation between nap and night

The correlation between nap and night is $-$.30 $\pm$.05, a low negative correlation. Partialling out age, this becomes $-$.44 $\pm$.05 which brings the correlation even lower. Since the correlation between night and age is .103, the negative correlation between nap and night becomes more negative when age is taken out due probably to the shortening of nap at the older ages.

Correlation between total sleep and mental age

The correlation between total sleep and mental age, obtained by partialling out chronological age, is $-$.33 $\pm$ .07. This shows a slight tendency for an inverse relationship between mental age and total sleep for the pre-school children. The mental age of the Castle children approximates the chronological age for those tested. The Vassar children tend to be the superior group mentally insofar as can

be told by the results of tests that are not absolutely comparable. The mental age of the Castle children in chronological group 4 years 0 months to 4 years 6 months was 4 years 6 months; and for the Vassar group, 5 years 8 months; for the Castle children in chronological group 4 years 7 months to 4 years 12 months, the mental age was 5 years 0 months; and for the Vassar group, 6 years 2 months.

Rhythm of total sleep

There seems to be a decided tendency for a long total sleep one day to be followed by a shorter amount the succeeding day. The daily sleep of the child from the 1 year 0 months group varied in the following way: 13 hours 50 minutes one day; 13 hours 15 minutes the next day; 12 hours 35 minutes; 13 hours 20 minutes; 14 hours 15 minutes; 12 hours 50 minutes, etc. This daily rise and fall seems to be characteristic throughout all age groups even in Hawaii where the temperature was fairly constant.

The influence of relative humidity on total sleep

The median total sleep at Castle for October 8, 11, 12, was 11 hours and 30 minutes. The relative humidity ranged from 66 to 67.5 for those days, which were of lowest relative humidity. The median total sleep for October 28, 29, 30, was 11 hours and 20 minutes and the relative humidity ranged from 71 to 80.5, which was the medium humidity. The median total sleep for November 3, 4, 5, was 11 hours and 20 minutes, and the relative humidity ranged from 87.5 to 89, which was the highest humidity. The terms low, medium, and high humidity are relative and refer only to the humidity of Honolulu during this experiment. The median total sleep was 11 hours 30 minutes in the group of lowest humidity, and 11 hours 20 minutes in the next two groups, showing only 10 minutes variation which was probably due to chance rather than to humidity.

The influence of temperature on total sleep

The median total sleep for the Vassar group was 11 hours 35 minutes for the group of records on the 3 days of lowest temperature; 11 hours and 50 minutes on the days of medium temperature; and 11 hours and 25 minutes on the days of highest temperature. The temperature range was 68.5 to 70° on the lowest; 71 to 73.5° on the days of medium temperature; and 75 to 82.5° on the days of highest temperature. The median total sleep was 10 minutes less on the hottest days than on the coolest days, and 25 minutes more on the moderate days than on the hottest days. This shows a slight tendency for longer sleep on cooler days and best sleep on moderate days with a temperature between 71 and 73°. The regularity of temperature in Honolulu may account for longer sleep of the children than at Vassar.

CONCLUSIONS

The median time required to go to sleep at nap does not show any apparent tendency to increase or to decrease with age during the preschool period.

The median length of nap ranges from 40 to 90 minutes.

The frequency of naps decreases fairly regularly. The children slept 100 per cent of the days recorded between 1 year 0 months and 1 year 6 months; and 42 per cent of the days recorded between 5 years 7 months and 5 years 12 months.

The time required to go to sleep at night is from 5 minutes to 75 minutes. The range of the Vassar group was decidedly higher than that of the Castle group. The deferred sleep may have been caused by the longer nap in the afternoon.

The length of median night sleep decreases fairly regularly both in the Vassar and Castle groups from ages 1 year to 6 years. The Castle group tended to sleep longer at night on the whole than the Vassar group.

The median total sleep tends to decrease irregularly both at Castle and at Vassar, the youngest group at Castle, sleeping 12 hours 40 minutes; the oldest group sleeping 11 hours 20 minutes. The Vassar group tended to sleep from 10 to 45 minutes less than the Castle group.

The correlation between sleep at nap and at night would seem to indicate that longer night sleep for the older children is due to a shorter nap.

The correlation between total sleep and mental age shows a slight tendency for an inverse relationship between mental age and total sleep, which may have been a factor in causing shorter sleep for the superior Vassar group.

The rhythm of sleep is indicated by a line that fluctuates daily up and down, showing a tendency for long sleep one day to be followed by short sleep the next.

Relative humidity does not seem to have influenced the amount of total sleep in the study. The median total sleep on the days of highest and lowest humidity both being 11 hours 30 minutes, and on the days of medium relative humidity, 11 hours and 20 minutes.

The influence of temperature on total sleep is slight but shows a tendency for longer sleep on cooler days than on the hottest days with longest sleep on moderate days with a temperature between 71° and 73°. The regularity of temperature may account for the longer sleep of the Honolulu group.

Brief Reports

Infant Responses to Vertical Movements[1]

IN THE course of a study on labyrinthine responses in young infants some interesting observations were made on the effect of dropping infants through a distance of about two feet. Watson (3, 4) held that there are two things even the newborn infant is afraid of and only two. He concludes that the human infant shows fear only in the presence of loud, sharp sounds and when support or balance is suddenly disturbed. He reports that crying is an integral part of the fear pattern.

In a former study the writer (1) reported that when external conditions were kept constant in a continuous day and night study of infants no fear reactions were observed during the first ten days of life.

In regard to the fear pattern in response to loud tones we found in the first study reported in this series that crying never accompanied the presentation of loud tones to twelve infants. The present study presents some data concerning reactions to loss of support.[2]

Infants were raised in the supine position above the head of the experimenter, dropped, and caught after they had fallen through a distance of two feet. Twenty-four infants under one month were used as subjects and given a total of eighty-five trials, about four to each infant. The following tabulation shows that of the eighty-five trials, ten, or 12 per cent, resulted in no overt response, and seventy-five or 88 per cent of the trials resulted in some movement. Of these seventy-five successful responses thirty-five or 46 per cent were confined to the arms alone, two or 3 per cent to the legs alone, and thirty-eight or 51 per cent were response patterns involving both arms and legs. Many of these movements were of a tonic nature possibly suggesting vestibular stimulation. The most definite pattern observed in the arm movements

	RESPONSES	PER CENT
Present	75	88
Not present	10	12
Arms alone	35	46
Legs alone	2	3
Arms and legs together	38	51
Extensor-flexion movement in arms	13	
Extensor-flexion movement in legs	28	
Total extensor-flexion movements	41	53
Crying	2	3

[1] From Iowa Child Welfare Research Station, State University of Iowa, Iowa City, Iowa.

[2] A pattern analysis by means of the high speed motion picture camera is being made on labyrinthine responses in the Station's infant laboratory.

was a tonic extension with abduction followed by flexion of the arms to the chest (Moro's Umklammerungsreflex, 1918). This pattern occurred in thirteen trials. The same pattern was observed in leg movements in twenty-eight trials. Thus this pattern occurred in 53 per cent of the trials which resulted in movement. The abduction-extensor type of tonus was a characteristic aspect of almost every movement of the limbs. This suggests that these movements may be of a compensatory nature. Further, it is of interest to note that in the total of eighty-five trials only two trials were accompanied by crying.

In order to see if by raising the infant suddenly in the supine position against gravity the response patterns of infants varied from the former situation, twelve infants, two to thirty-three days in age, were used and given forty-five trials, an average of four trials per infant.

The results are indicated below:

	RESPONSES	PER CENT
Present	35	78
Not present	10	22
Total number of trials	45	100
Arms alone	18	51
Legs alone	2	6
Arms and legs together	15	43
Crying	0	0

Ten trials or 22 per cent evoked no responses whatever, and thirty-five trials or 78 per cent resulted in limb movement of some kind. The extensor-flexion pattern is not as prominent as in the first experiment but the tonic extensor effect is still present. Of the thirty-five trials 51 per cent are made by arms alone, 6 per cent by legs alone, and 43 per cent by arms and legs together.

No crying accompanied the forty-five trials.

CONCLUSIONS

The following conclusions may be drawn from this study:

1. When twenty-one infants were dropped eighty-five times, no responses occurred in 12 per cent of the trials, and various patterns of limb movements occurred in 88 per cent of the trials.

2. The most definite pattern was an extensor-flexor pattern which was present in 53 per cent of the successful trials.

3. Of eighty-five trials of loss of support crying occurred only in two instances.

4. When twelve infants were accellerated against gravity forty-five times, no responses occurred in 22 per cent of the trials, and various patterns of limb movements occurred in 78 per cent of the trials.

5. The extensor-flexor pattern was not as striking as under the first set of conditions.

6. Responses showed a tonic character.

7. It is suggested that responses to vertical acceleration may be a compensatory effect.

8. Crying accompanied two trials in a total of 130 trials.

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Food Selections of Nursery School Children*

THE Nursery School meal affords the opportunity for the study of certain food habits of young children. Every nursery school teacher knows that some meals are eaten with relish and are over within twenty or twenty-five minutes while others are drawn out to the limit of the alloted time on the program. It was with a view of determining to what extent there might be preferences for some foods over others in the noon-day menus that we began to record the order in which the children tasted the foods on their plate as well as the order in which they finished them. We are reporting here the observations for the spring and fall quarters of 1929 and the winter and summer quarters of 1930.

There was an enrollment of twenty-four children for all quarters excepting the spring when there were twenty-seven on the roll. The enrollment for the noon-day meal, however, did not exceed fourteen during any quarter since the facilities were insufficient for more than that number. Consequently, the children were divided into two groups. For the first half of the quarter the one group stayed for the meal as well as for the afternoon nap; for the second half, the other group remained.

While as many as from twelve to fourteen children might have been present at any one meal, the attendance usually varied below this maximum. A member of the staff and two graduate students each of whom had had a quarter or two of previous work in the Nursery School served as recorders. A recorder never attempted to observe more than six children. Usually two recorders were available for the noon-day period but occasionally only one; consequently, there were meals when not all the children were observed. Variations

* This investigation was conducted in the Nursery School of the Iowa State College. Much credit is due Miss Marie Harper, a graduate student in the Department of Child Development who assisted in the collection and the classification of the data.

in attendance, changes in location in the dining room on the part of both children and recorders and the availability of recorders were the factors determining the children that were observed. In all, forty-four different children are included in the records. The frequency of observations per child ranges from two to sixty-one, the average being twenty-five.

The typical meal had four foods on the plate: meat or eggs, two vegetables and a sandwich. Milk was served with the main course. Dessert was served only on condition that the plate was cleaned. However, this study is concerned only with the food on the plate.

The record card was a cross-ruled arrangement with the names of the children in the column to the left and the foods served written at the tops of the four double columns. One of the double columns in each case was for recording the order of tasting and the other the order of finishing the particular food. With four foods on the plate, Number 1 was recorded for each child for each food tasted first, 2 for the one tasted second, etc. The same method was used for recording the order of finishing. The values in columns III and IV of table 1 are the averages of these ranks.

The records for the tasting do not represent one-hundred per cent accuracy. On those days when a recorder had a full quota of subjects to observe and when the children were unusually hungry some detail might escape the eye of the recorder. The record for finishing is more reliable. There was some difficulty here however, particularly when a child had the foods on his plate badly mixed.

The results are summarized in the tables.

Table 1 gives the foods arranged in the order of the average rank for finishing. Crisp bacon heads the list with a rank of 1.87 for tasting and 1.46 for finishing as may be seen in columns III and IV. Columns V and VI indicate, to take the first item as an example, that 28 meals were observed when bacon was served with a sum-total of 230 subjects. Buttered kohlrabi brings up the rear. It was observed at only one meal when five children were present. The actual range, on a possible range of three, is 2.54.

Table 2 is a classified summary of table 1. The classification is on the basis of the kind of food as indicated by its name. The numbers in parentheses are the serial numbers of the foods in table 1 which were included in the particular class. It appears from the table that meats, apples, sandwiches, fish and eggs are finished early in the meal while the vegetables are left until the last. With the exception of fish the foods served less frequently tend to remain last on the plate. Conversely, with the exception of potatoes, cabbage and carrots, the foods served most frequently tend to be eaten first. The low rank of potatoes would scarcely have been predicted.

Table 3 is also a classified summary of table 1. Here the classification is on the basis of the mode of preparation. The broiled foods are the preferred meats. Sandwiches and toast may rank high because they are eaten with the fingers rather than with the spoon or fork, which may be a partial explanation of the preferences for raw

TABLE 1

Average rank for tasting and finishing arranged on the basis of finishing

I RANK NUMBER	II NAME OF FOOD	III TASTING RANK	IV FINISHING RANK	V MEALS OBSERVED	VI CHILDREN OBSERVED
1	Bacon, crisp	1.87	1.46	28	230
2	Tomato sandwich	1.86	1.73	3	15
3	Celery sandwich	1.80	1.80	1	5
4	Apple rings	2.43	1.86	1	7
5	Meat balls	1.74	1.91	12	93
6	Liver, broiled	1.67	2.00	1	11
7	Salmon loaf	1.60	2.00	1	5
8	Meat loaf	1.89	2.15	4	28
9	Eggs, goldenrod	2.29	2.16	6	43
10	Peanut butter sandwich	1.83	2.20	14	134
11	Celery cabbage	2.51	2.22	2	23
12	Liver, creamed	2.08	2.24	3	22
13	Apple sandwich	2.43	2.25	19	141
14	Turnips, raw	2.13	2.25	2	20
15	Celery, crisp	2.55	2.27	15	118
16	Bread & butter sandwich	2.30	2.28	52	383
17	Peas, creamed	2.39	2.29	5	38
18	Baked haddock and tomato sauce	1.90	2.29	1	10
19	Lettuce sandwich	2.18	2.30	11	84
20	Tomato, sliced	2.49	2.31	5	30
21	Eggs, creamed	2.34	2.32	5	34
22	Eggs, scrambled	2.55	2.32	30	233
23	Eggs and pea souffle	2.14	2.34	4	36
24	Cabbage sandwiches	2.44	2.34	7	56
25	Carrots, raw	2.36	2.35	5	37
26	Green beans, buttered	2.46	2.39	6	39
27	Eggs, coddled	2.21	2.40	4	42
28	Croutons	2.40	2.40	1	10
29	Celery and cabbage salad	2.50	2.40	1	6
30	Baked haddock and white sauce	2.14	2.40	1	12
31	Eggs, baked	2.28	2.41	5	30
32	Tomato, stewed	2.59	2.42	10	74
33	Toast	2.30	2.47	26	249
34	Liver loaf	2.25	2.50	1	4
35	Pea soup, creamed	2.43	2.52	3	23
36	Potato, scalloped	2.50	2.57	6	56
37	Eggs, poached and spinach	2.19	2.58	3	26
38	Eggs, shirred	2.30	2.58	4	26
39	Bean sprouts	2.00	2.60	2	10
40	Wax beans, creamed	2.50	2.66	1	6
41	Asparagus, creamed	3.73	2.66	1	6
42	Lettuce, crisp	3.11	2.67	23	182
43	Spinach, buttered	2.96	2.67	9	76
44	Cheese, cottage	2.88	2.68	6	61
45	Peas, buttered	2.66	2.69	11	69
46	Eggs, poached	2.14	2.71	1	7

TABLE 1—*Concluded*

I RANK NUMBER	II NAME OF FOOD	III TASTING RANK	IV FINISHING RANK	V MEALS OBSERVED	VI CHILDREN OBSERVED
47	Beet greens	3.56	2.72	1	5
48	Baked haddock	2.89	2.72	3	21
49	Tomato soup	2.57	2.75	8	64
50	Potato, mashed	2.97	2.76	11	78
51	Carrots & celery, creamed	2.97	2.78	3	18
52	Beets, buttered	2.32	2.79	9	66
53	Squash	1.81	2.80	1	5
54	Potato, baked	2.60	2.81	11	89
55	Tomato, scalloped	2.92	2.83	1	12
56	Brussel sprouts	3.57	2.86	1	7
57	Cabbage salad	2.90	2.87	11	78
58	Carrots, buttered	2.87	2.90	5	32
59	Vegetable beef soup	2.49	2.92	8	86
60	Carrots, creamed	3.05	2.94	10	73
61	Peas and carrots, creamed	2.74	2.97	2	22
62	Potato, creamed	3.19	2.99	10	74
63	Green beans, creamed	2.68	3.01	4	23
64	Celery soup, creamed	1.86	3.09	3	34
65	Cabbage & carrot salad	3.24	3.10	4	37
66	Liver casserole	2.69	3.14	6	47
67	Celery, creamed	3.35	3.16	5	36
68	Cauliflower, buttered	2.67	3.19	2	21
69	Kohlrabi salad	3.40	3.20	1	5
70	Macaroni and tomato	2.56	3.21	4	31
71	Carrot & celery salad	3.23	3.23	2	13
72	Peas & carrots, buttered	2.88	3.24	2	16
73	Potato and ham scalloped	2.83	3.31	1	6
74	Spinach soup, creamed	2.67	3.33	1	9
75	Vegetable beef stew	3.33	3.33	1	6
76	Broccoli, buttered	3.42	3.33	2	12
77	Asparagus, creamed on toast	2.40	3.36	1	5
78	Cabbage, creamed	3.01	3.37	5	45
79	Turnips, mashed	3.80	3.40	1	5
80	Tomato aspic jelly on lettuce	3.00	3.40	1	5
81	Cabbage, buttered	3.70	3.40	1	10
82	Onions, creamed	3.26	3.47	5	45
83	Cabbage, raw	3.60	3.50	1	10
84	Turnips, creamed	3.42	3.50	1	12
85	Tomato and rice	3.75	3.50	1	4
86	Kohlrabi, buttered	3.20	4.00	1	5

vegetables over the buttered and the creamed.

In general, the fact that vegetables are found neither in the first six items of table 2 nor the first four of table 3, excepting as occasionally they were served raw in sandwiches, supports the observation of Shelly, (4) Imlay, (1)

TABLE 2

Order of finishing foods according to kind

I CLASS NUMBER	II NAME	III AVERAGE RANK	IV MEALS OBSERVED	V SUBJECTS OBSERVED
1	Meats (1, 5, 6, 8, 12, 34, 66, 73, 75)	1.88	57	447
2	Apples (4, 13)	2.23	20	148
3	Sandwiches (2, 3, 10, 13, 16, 19, 24)	2.25	107	818
4	Fish (7, 18, 30)	2.29	3	27
5	Eggs (9, 21, 22, 23, 27, 31, 37, 38, 46)	2.35	62	469
6	Toast (28, 33)	2.47	27	259
7	Lettuce (19, 42, 80)	2.57	35	271
8	Celery (3, 11, 15, 29, 51, 64, 67, 71)	2.58	32	253
9	Tomatoes (2, 18, 25, 32, 49, 55, 70, 80, 85)	2.60	34	245
10	Peas (17, 23, 35, 45, 61, 72)	2.61	27	204
11	Beans (26, 39, 40, 63)	2.62	13	78
12	Cheese (44)	2.67	6	61
13	Spinach (37, 43, 74)	2.71	13	103
14	Turnips (14, 79, 84)	2.74	4	37
15	Beets (47, 52)	2.79	10	71
16	Squash (53)	2.80	1	5
17	Potatoes (36, 50, 54, 62, 73)	2.81	39	303
18	Cabbage (11, 24, 29, 57, 65, 78, 81, 83)	2.85	32	265
19	Brussel sprouts (56)	2.86	1	7
20	Carrots (25, 51, 58, 60, 61, 65, 71, 72)	2.90	33	248
21	Asparagus (41, 77)	2.98	2	11
22	Cauliflower (68)	3.19	2	11
23	Broccoli (76)	3.33	2	12
24	Onions (82)	3.47	5	45
25	Kohlrabi (69, 86)	3.60	2	10

TABLE 3

Order of finishing foods according to preparation

I CLASS NUMBER	II MODE OF PREPARATION	III AVERAGE RANK	IV MEALS OBSERVED	V SUBJECTS OBSERVED
1	Broiled (1, 5, 6)	1.60	41	334
2	Sandwiches (2, 3, 10, 13, 16, 19, 24)	2.26	107	818
3	Below boiling (22, 27, 44, 46, 80)	2.42	42	348
4	Toast (28, 33)	2.47	27	259
5	Raw (11, 14, 15, 20, 25, 29, 42, 57, 65, 69, 71, 83)	2.60	72	559
6	Boiled (4, 32, 50, 75, 79)	2.61	24	170
7	Baked (7, 8, 18, 30, 31, 34, 36, 38, 48, 53, 54, 55, 73, 85)	2.61	41	308
8	Buttered (26, 39, 43, 45, 47, 52, 56, 68, 72, 76, 78, 82, 86)	2.80	52	368
9	Combinations, cooked (23, 37, 51, 66, 70)	2.85	20	150
10	Soups (35, 49, 59, 64, 74)	2.87	23	216
11	Creamed (9, 12, 17, 21, 40, 41, 51, 60, 61, 62, 63, 67, 77, 78, 82, 84)	2.87	67	503

Thurston (5) and Prentiss (3) as regards the relatively unfavorable reactions of children to vegetables.

The rank of the vegetables with respect to the mode of preparation as indicated in table 3 is at least not inconsistent with the findings of Neely (2) with thirty-six Mexican children enrolled in the Experimental and Demonstration School of the Texas College of Arts and Sciences. She used boiled turnip greens; both raw and boiled turnips, celery and cauliflower; and raw, boiled and pureed carrots and spinach. The vegetables were all served separately in small portions prior to the noonday meal. These vegetables were all quite unfamiliar to this group of children. While the number of servings was too limited to make her findings very significant they were in the direction of a preference for either the raw or the boiled that had retained their form over the soft or the pureed.

It appears in general that the food combinations do not go as well as each item served separately. There were nine combinations of food in which each of the constituents appeared separately so that comparisons may be made between the combinations and each food served alone. Of these combinations, six or 66⅔ per cent had larger averages than either of the elements served separately. Of the three combinations where only one of the elements had been served separately, the averages in every case were higher than for the one taken alone. Apparently we cannot justify the serving of foods in combinations to children on the basis of making the components more palatable. There are of course other reasons for serving foods in combinations not the least of which is that the child will sooner or later find such combinations placed before him and he should learn to eat them not only to make himself socially acceptable but to guarantee a balanced meal.

In every case the children were checked carefully on the time that it took them to clean the plate. The average time that it took the children to finish the main course varied somewhat with the season of the year. Appetite seemed to be the poorest during the months of December, January, June and July, reaching its lowest point in July and its highest in May. The average time for finishing the dinner course in May was practically 16 minutes while in July it was 27 minutes. Correlations of $-.10$ for mental ages on the Merrill-Palmer Scale and time of finishing and of $-.21$ for chronological ages and time of finishing are both insignificant.

A correlation of .79 between order of tasting and order of finishing indicates a general tendency for the children to finish the foods in the same order in which they taste them.

Why the children finish the foods on the plate in the order in which they do is doubtless due to a combination of several factors. It is the writer's opinion that so-called taste preference is the largest single factor which is to be understood to include smell, taste, tactual and temperature qualities, visual appeal, and conditioning as the result of previous emotional reactions in connection with the food. The physical factors are also important.

The mechanical difficulties of eating certain foods are greater than with others. As adults well know, it requires greater skill in getting some foods to the mouth than others, and at least greater endurance in ingesting them once they have arrived.

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A Preliminary Report on a Study of Fetal Conditioning*

THIS paper is a preliminary report of an attempt to condition a human fetus. The main part of the report concerns the method used for recording the fetal movements. Movements have been recorded (Hicks (2)) by putting a spirograph belt around the mother's abdomen, but this gives a record of the maternal respiration with the fetal movements superimposed and showing merely as irregularities on the respiratory record. We wanted a record which would show the fetal movements only. In order to make such a record we placed a two inch tambour, diaphragm side down, on the mother's abdomen and fastened it there with adhesive tape. The tambour was light enough to ride up and down with the respiratory movements, but heavy enough that the more sudden movements of the abdominal wall due to the kicks of the fetus beneath reacted against the inertia of the tambour and sent a wave up the connecting tubing to a recording tambour. The record was made on smoked paper running on a long paper kymograph. Three such pairs of tambours were used. The attending physician and the writer attempted to place the tambours as follows; one close to the fetus' shoulders, one close to the base of its spine, and the third a little to one side of the latter in a position approximately over the knees. It was necessary to use several tambours because the fetus moves around and because the movements which we attempted to record may have their greatest amplitude in different parts of the fetal body at different times. We considered that a record on any one of the tambours was as good as a

* This work was done incidentally to the writer's general work as a research assistant at Yale University during the Spring of 1931.

record on any other one, and, for the same reason, the height of the excursion of the lever of the recording tambour has no relation to the extensity of the fetal movement.

In order to demonstrate that the movement was truly fetal and not maternal we also took a record of the mother's breathing with a Verdin pneumograph and a pulse record with an Erlanger sphygmomanometer. The one mother whose coöperation we have been able to secure so far breathed so irregularly at all times that the respiratory record is of no value, but at least we can say that no changes in the sphygmomanometer record in conjunction with the fetal movements have been noted. We also gave the mother, who was a para II, a key to press when she felt the fetal kick. The key actuated a signal marker. The maternal record coincided with the fetal record in enough instances to lend weight to the assumption that the tambour records are truly fetal. In some instances, however, the mother recorded movements which did not show on the tambour record or the tambours recorded a movement which the mother did not register. We believe that the records which we have made are truly fetal because: (1) the tambour records coincided temporarily, as far as could be seen, with the movements of the maternal abdominal wall as observed by the physician present and by the writer, (2) because the fetal tambour coincided fairly well with the maternal key record, (3) because no maternal movements were observable through the record of the sphygmomanometer, and (4) because we can think of no part of the mother's anatomy which might produce such movements as a reaction to the stimulus used, a loud sound. I might say that the mother was warned a second or two before the sound each time and that she was so perfectly relaxed that gross, external, 'startle' movements were noted only once out of several dozen applications of the stimuli.

The "native" stimulus used was a loud sound produced by the banging together of two boards by a stout spring taken from a rat trap of the snap variety. The apparatus was fastened to the side of an empty wooden box to increase the intensity of the sound, and placed about two feet to one side of the mother. The stimulus to which the conditioning was to be set up—the "conditioned stimulus" —was a vibration. To produce this we took an ordinary electric bell, removed the gong, bent the striker at right angles to its original position, and soldered shut the make and break contact. The bell was then attached through a transformer to the 110 volt A.C. lighting circuit. When the circuit was closed the A.C. caused the striker to move rapidly up and down. The bell was held by a support in such a position that the clapper pressed against the maternal abdomen somewhere inside the triangle formed by the tambours, not always in the same place.

In use, the vibration was applied for approximately five seconds and then the sound apparatus trigger was released. Both stimuli were recorded by electromagnetic markers on the smoked paper.

One serious difficulty encountered

during the course of the work has not yet been overcome, although it can easily be obviated in the future. Both Forbes and Forbes (1) and Peiper (3) have noticed that after the fetus is stimulated some considerable period of time must elapse before it will again react to the stimulus. After some rather cursory preliminary experimenting we were inclined to doubt this. Later in the course of the work we were again convinced of the existence of this phenomenon, but by this time we had passed the preliminary control period in which the vibratory stimulus had been tested to see if it alone gave the fetal reaction. If a tentative guess may be permitted, it seems that a period of about four minutes after the stimulus is sufficient time for this effect to pass off.

To conclude, we have fairly conclusively demonstrated to ourselves two facts; first, that records can be made of fetal movements, and second, a fact that has already been reported, that an external sound will produce a marked fetal reaction.

The fetus with which the above work was done was born May 3rd, 1931 at the New Haven Hospital, a girl. She has, so far, shown no ill effects from her pre-natal education.

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